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Agricultural Gazette of New South Wales.

Championship Field Wheat Competition in the Central-western District.

[In 1922 the Royal Agricultural Society promoted Championship Field Wheat Competitions, and, with the approval of the Minister for Agriculture, Mr H. C. Stening, Manager, Temora Experiment Farm, acted as judge. The following extracts from the report as to the Central-western District competition furnished to the President and Council of the Society by Mr. Stening, will be found of interest to all wheat-growers.]

In the part of the State covered by this competition, the season has been most unfavourable for the successful production of wheat, resulting in the abandonment of the local competitions in two districts, namely, Condobolin and Gilgandra. The district societies which conducted local competitions were Forbes, Parkes, Peak Hill, Narromine, and Dubbo, and the judging for the championship commenced at Forbes on 6th November and was completed at Dubbo on 8th November. The crops generally in the southernmost districts of Forbes and Parkes were superior to those in the more northern districts bearing a relation to the total effective rainfalls registered in the districts during the period April to October. According to the figures of the Commonwealth Department of Meteorology, the rainfall varied for the period from 10·37 inches at Parkes to 6·88 inches at Dubbo and Narromine, representing 2 inches below the average at Parkes and 5·60 inches below the average for the period at Dubbo.

The winter rains during the months of June and July were well up to the average in all the districts, but it was the deficiency of both the autumn rains (April-May) and spring rains (August-October) that was responsible for the prospective low average yields throughout the areas included in the competition; these were below the average to the amount of 1·50 and 1·57 inches respectively at Parkes and 2·84 and 2·72 inches respectively at Dubbo.

The prizewinners are:—Mr. A. Millgate, Parkes, 1; Mr. H. F. Sweeney, Forbes, 2; and Mr. C. J. Hopkins, Dubbo, 3.

The champion crop was sown on fallowed land, which had produced fourteen crops previously, the two preceding ones being oats. It was ploughed 4½ inches deep in September, cultivated with the spring-tooth cultivator in October and again in January, cultivated with the disc cultivator in March, and with the spring-tooth cultivator prior to sowing on 15th to 17th May. Canberra was the variety, sown at the rate of 45 lb. of seed with 56 lb. superphosphate per acre. The crop was very even and true to type, and was estimated to yield 29 bushels per acre. The only fungus disease present was a little flag smut, and there were also a few black oats, which were not showing above the crop.

The crop of Federation which won second prize for Mr. Sweeney was sown on land fallowed 4½ inches deep in September, disc-cultivated in

March, and harrowed before sowing, which took place on 1st April at the rate of 50 lb. seed and 40 lb. superphosphate per acre. The crop, which was the sixth grown on the land, contained a few "strangers" and a little take-all. The fertiliser had not been applied uniformly, and strips through the crop which had apparently received no fertiliser were lighter in yield and more backward in maturity than the manured portion.

Much credit is due to Mr. C. J. Hopkins, who gained third prize with a crop of Canberra which promised the highest yield in the competition, and which was grown on black alluvial soil which had been cropped for forty-six years. Crops grown on such a fertile soil require more moisture than those on the less fertile wheat lands, and are usually the first to fail under drought conditions. Although no record was kept of the rainfall at the farm, one could surmise that, by reason of the locality of the crop, it would have received as little rain as any crop in the competition. The success of this crop was due mainly to the moisture conserved in the soil by the excellent cultivation methods adopted. The land was fallowed 5 inches deep in July, and disced and harrowed the second week in August, and the fallow received similar cultivation at the end of September and beginning of November, and was harrowed before sowing on 16th April with 40 lb. seed and without any fertiliser. The cultivations during the spring months with the disc cultivator, followed by the harrows to "fine" the soil, were carried out chiefly with a view to the eradication of wild oats, but they must also have had a very marked effect in the conservation of moisture in the soil.

The sowing as early as mid-April of an early-maturing variety like Canberra, known to possess a weak straw, is a practice not to be recommended under normal conditions, particularly on rich land. Presumably the crop in this instance was sown early with a view to outstripping and smothering wild oats: and as the season shaped it proved successful from a yielding standpoint. Unfortunately the crop did not score well in other respects, for it was by no means pure, and there were also present a little flag smut and an odd bunted head, as well as black oats. The presence of the latter is not very surprising on rich land cropped for so long as forty-six years, but Mr. Hopkins is on the right track towards their complete eradication.

Messrs. Bartlett Bros.' crop was on new land, and Mr. R. Griffith's crop on land that had not been cropped for several years, and both crops therefore had to concede to crops grown on old land 6 points under the heading of "Cleanliness" and 4 points under "Condition and appearance." The former was a high-yielding crop which suffered severely in points for "Freedom from disease" on account of the presence of bunt, while the yield of the latter was lighter owing to a thin stand, doubtless due to poor stooling, resulting from a late seeding.

Cultivation Methods.

One of the chief educational advantages of crop competitions is that they point out by what methods of cultivation the best crops are produced, and the lessons taught by them in a season of deficient rainfall are especially

valuable. It is significant that the whole of the crops which won the local competitions, and were therefore eligible for competition for the championship, were grown on fallowed land, and the experience of the season should do much to bring home to farmers the great value of fallowing, and encourage them to make it a more general practice. There is still room for improvement in the methods adopted in fallowing in the west. The land should be ploughed earlier than appears to be the general practice, and more attention might be given to the cultivation of the fallows during the spring months. The advantage of this is demonstrated by Mr. Hopkins' remarkable crop, which was produced on land fallowed in July, the fallow receiving three cultivations in the spring.

Two of the five crops inspected were grown without an application of fertiliser. It may be questionable whether superphosphate would be of value on the alluvial land on which the Dubbo crop was grown, but it would probably have benefited the crop at Alectown, although grown on new fallowed land.

There appears to be some doubt as to the efficacy of superphosphate in portions of the west, but at Forbes and Parkes unmanured strips through the crops were excellent object lessons in proving the value of superphosphate on similar soils, the unmanured portions being much inferior as regards growth and yield and more backward in maturity.

Varieties.

Of the five crops judged to be the best in their respective districts, three, and a portion of the fourth, were of the Canberra variety. The success of Canberra under adverse conditions may be regarded as a triumph. Since its introduction by the Department of Agriculture eight years ago Canberra has become a favourite in the Riverina by proving its superiority as a consistent grain yielder over all other quick-maturing varieties, and it must now be stamped as one of the most valuable varieties for the western districts.

Federation also gave an indication of its value as a bag-filler in dry seasons; on account of its strong straw it is comparatively more safe than most other varieties for the sowing of large areas. Of the varieties included in Mr. Griffith's competing crop, Gresley promises very well as an early-maturing dual-purpose variety.

Diseases.

Flag smut was fairly prevalent, and there was also a little take-all. Two crops were infected with bunt; in one case, however, to only a small extent. In each instance the infected crop was Canberra, and in general Canberra is earning a reputation of being very susceptible to bunt. Late-sown crops are always more subject to attacks of bunt than early-sown crops, and as Canberra is essentially a variety for late sowing, it becomes more susceptible on this account. By avoiding the use of infected seed, and giving proper attention to pickling and keeping seed free from infection there should be no danger of loss by bunt.

Details of Awards.

Competitor's Name and Address.	Local Society.	Variety.	Methods of Cultivation.	Date of Seeding.	Quantity of Seed per acre.	Quantity of Super phosphate per acre.	Effective Rainfall (April October).	Number of Crops previously grown.	Yield.†	Trueness to Type, Max. 20.	Freedom from Disease, Max. 20.	Evenness, Max. 20.	Cleanliness.‡	Condition and Appearance.§	Total.
					lb.	lb.	points.								
A. Millgate, "Rockvale," Parkes.	Parkes	Canberra	Fallowed 4½ inches September; spring-tooth cultivated October and January; disced March; spring tooth cultivated before sowing	15th to 17th May	45	56	667	14	29	19	19	19	27	27	140
H. F. Sweeney, "Cherry Tree Hill," Forbes	Forbes	Federation	Fallowed 4½ inches September; disced March; harrowed prior to sowing.	1st April.	50	40		5	30	18	18	18	26	23	133
C. J. Hopkins "Oxlea," Dubbo.	Dubbo	Canberra	Fallowed 5 inches July; disced and harrowed second week in August disced and harrowed end September; disced and harrowed first week November; harrowed before sowing	16th April	40	Nil		Cropped for 46 years.	31	15	16	18	25	27	132
Bartlett Bros., "Freehome," Alectown.	Peak Hill	Canberra	Fallowed 5 inches July to October; spring-tooth cultivated November; disced January; spring toothed before sowing	First Week in May	42	Nil	766	First crop	30	18	12	19	23	23	125
R. Griffith, "Kabinga," Narromine.	Narromine	Canberra, Florence, Gresley, Billy Hughes, Red Wings and Imp. Steinwedel	Fallowed 4½ inches August; disced October; spring-toothed February; spring toothed prior to sowing	First Week in June	55	56	505	First crop	17	19	19	18	23	23	119

* Registration within a mile of competing crop. † One point for each bushel of apparent yield.
‡ Maximum for first crop, 24 points; second, 25; third, 26; fourth, 27; fifth, 28; sixth, 29; over six crops, 30.
§ Maximum for first crop, 24 points; second, 24½; third, 25; fourth, 25½; fifth, 26; sixth, 26½; seven, 27; over seven crops, 28.

The seed in the case of the badly infected crop was pickled with 1½ per cent. solution of bluestone, but had contained bunt balls. As the solution does not penetrate the bunt balls during the short time of immersion, the spores contained therein are not killed, and when these later become broken (for instance, in drilling) the free spores are scattered among the grain, which is thus reinfected. The safest course is never to use seed known to be infected.

The results of the competition go far to prove the value of crop competitions in general. They show that, in a division of the State where the average yield is expected to be less than two bags, it is possible, by good farming methods, to produce crops yielding ten bags per acre, and they also plainly demonstrate to wheat-growers the advisability of adopting improved methods of cultivation as an insurance against drought and as a means of placing the industry on a sounder basis.

Particulars of the cultural treatment of the crops entered and the points awarded in the judging are set out in the table on page 4.

THE MARKETING OF AUSTRALIAN MEAT OVERSEAS.

AT the conference of southern branches of the Agricultural Bureau held recently at Harden a discussion concerning the marketing of Australian meat overseas resulted in the adoption of the resolution: "That immediate inquiries be instituted and investigations be made through the correct source as to the manner and conditions under which our export beef and mutton are marketed."

The terms of the resolution were subsequently conveyed by the Department to the Chairman of the Australian Meat Council, Mr J. B. Cramsie, who, in his reply, stated that the matters referred to were receiving the attention of the Council, and that it was its intention to send a delegation to England for the purpose of investigating the conditions of arrival and marketing, and the cost of handling, cold storage accommodation, and overhead selling charges. As a result of these investigations it would be possible eventually to advise fully on existing conditions and to make recommendations for the more efficient and economical handling of the product. At the conclusion of its inquiries at English ports, the delegation would proceed to South America for the purpose of studying the conditions ruling in the Argentine, Brazil, and Uruguay. The investigations would deal with the methods and costs of railage of live stock, meat works costs, the handling and get-up of the meat, and shipping facilities. Inquiries would also be made into the cost of production of both beef and mutton, and such other matters as would provide a basis of profitable comparison.

THE ravages of blue mould of tobacco continue to be serious, but with a view to breeding a resistant type of tobacco suitable for local conditions, importations are being made of a large number of varieties of cultivated and wild tobacco for testing in relation to the disease.—J. P. SHELTON, Plant Breeder.

The Increased Activity of the Agricultural Bureau.

That the Bureau movement is making steady progress in New South Wales is proved by the following figures:—In 1918, there were fifty-four branches of the Bureau reporting meetings, but of these only twenty-five reported more than five meetings in the year. In 1919 there were sixty branches, of which only eighteen reported more than five meetings. In 1920 the number of branches had increased to ninety, but the number reporting more than five meetings was only thirty-eight. In 1921 there were 120 branches, sixty-three of which reported more than five meetings, while in June, 1922, there were 165 branches, the majority in full operation, no less than 132 reporting regular meetings.

Thus, while the growth in actual number of branches has been considerable, there has been a marked increase in the activity of the branches also. Membership of branches has also increased, and a feature in this connection has been the admittance to most branches of women and children as associate members.—C. C. Crane, Bureau Organiser.

The Construction of a Concrete Swimming Bath.

A correspondent interested in a movement to construct a community swimming bath recently approached the Department for advice in the matter. Plenty of water was available to fill the bath by gravitation at the site suggested, said the writer, but the soil (red volcanic scrub) was porous, so that the bath would need to be walled and floored with some watertight material. It was proposed to make the bath 66 feet long by 20 feet wide, the bottom to slope from 2 feet 6 inches to 6 feet. What should be the method of construction and what would be the quantities of material needed?

The walls and floor of such a bath, the correspondent was informed, would have to be lined with concrete, and, as the inquiry suggested that the labour employed would be largely inexperienced, extra thickness to the extent of one-third would be allowed in the specifications given. The walls and floor should be 9 inches thick, and the former should be reinforced with ½-inch vertical steel round rods at 3 feet centres, and with heavy-gauge wire-netting (pig fence wire-netting would do) tied to the verticals. The shallow end wall would not require this. The floor should have wire-netting only at about 2 inches from the bottom.

The concrete should be of broken stone of about 1-inch guage, mixed with clean sharp sand and Portland cement, in the proportion of 9 cubic feet of stone to 4 cubic feet of sand and one bag of cement. The excavation should be cut out neatly to the outside size (67 feet 6 inches by 21 feet 6 inches), and for the walls good boxing would be required to hold the cement in position. The boxing should consist of 4 by 2 inch uprights and 1 inch thick boards set up and stayed.

The quantity of concrete required would be about 62 cubic yards, and for this 186 bags of cement would be necessary, together with another 20 bags for the plastering of the face of the walls and the floor with cement mortar ⅜ inch thick. If this plastering coat was mixed with a waterproofing powder according to the directions supplied with the latter the surfaces treated should be thoroughly watertight.—A. Brooks, Works Superintendent.

Some Recent Views on the Liming of Soils.*

H. WENHOLZ, B.Sc. (Agr.), Special Agricultural Instructor.

AGRICULTURAL chemists generally now freely admit that whatever else a chemical analysis of the soil may indicate, it cannot determine the fertiliser requirement of a soil, or more particularly the kind and amount of fertiliser or fertilisers which will give the most profitable increase in yield with a particular crop. Field trials over a number of years on a crop or system of cropping for different soils in a particular district are now recognised to afford the only reliable data as to the most profitable fertiliser mixture in kind and amount.

Now that the question of recommending fertilisers for farmers is one in which the advice of the field experimentalist is sought rather than that of the agricultural chemist, it behoves us also to consider whether advice concerning the liming of the soil should be given by the chemist or by the field experimentalist. Very largely, up to the present, the advice of the agricultural chemist on liming the soil has never been questioned. On the results of the reaction of the wet soil tested with litmus paper, or the determination of the lime requirement of the soil by the Veitch or Truog method, the hydrogen-ion concentration by electrometric or calorimetric methods or by other means, or on the quantitative determination of the percentage of lime present in the soil, agricultural chemists still generally advise the application of lime to the soil.

Lime as a Direct or Indirect Plant-food.

The claim has long been made that liming the soil is beneficial on account of the additional direct plant-food, or of the indirect increase in the soil of other plant-food materials, such as phosphorus and potash, due to liming. As for its value in adding a direct source of plant-food, lime may probably be entirely neglected in most soils. As for the statement that lime has the direct chemical power of liberating potash and phosphoric acid from their insoluble combinations and rendering them available as plant-food material, it is now realised that it is somewhat over-ambitious. If lime has any effect in bringing about increased crops, it is probably because of the more favourable conditions for the bacteria which break down the organic matter and increase the moisture-holding capacity of the soil, which in its turn increases the available plant-food. In any case, one would not think of applying lime at the rate of tons per acre to set free phosphoric acid which can be applied far more cheaply and profitably in superphosphate at the rate of pounds per acre, and the same probably holds with potash, even at its much higher price.

* Paper to be read at the meeting of the Australasian Society for the Advancement of Science, which is being held at Wellington, New Zealand, in the present month (January, 1923).

Physical Effect on Soils.

The supposed beneficial action of lime in binding the soil particles on a sandy soil together has been recently questioned by American investigators, and if lime is to be applied for its beneficial effect in this direction alone, it must be borne in mind that many sandy soils are of poor agricultural or capital value, and that the land may not bear the heavy added capitalisation of liming, or that it may be more cheaply improved in physical tilth by other means.

Lime undoubtedly has the effect of opening up and lightening stiff clay soils, but it is also doubtful here whether its use can be unhesitatingly recommended in all cases. Deep, thick rooting crops, and the subsequent decay of these roots in the soil, or the use of organic matter of animal or vegetable origin may be sufficiently effective at less cost. Soils which have been for some time under cultivated crops have lost a considerable amount of their organic matter, and have a greater tendency to run together easily and bake after rain, yet the addition of organic matter by some systematic rotation with pasture, grazing fodder crops with stock, or animal or green manuring is known to be a simple and effective expedient in many cases to remedy this physical defect without the costly application of lime.

Lime Exhausts the Organic Matter in the Soil

It is well known that quick-lime and the hydrate (of which there is generally a certain amount in agricultural lime) has the effect of oxidising the organic matter in the soil. This effect is well known to English farmers, whose old adage should not be forgotten:—

> "Lime and lime without manure
> Make both farm and farmer poor"

Now in England on the European continent, and in America the land is much more intensively cultivated than in Australia, and on the small areas in the former countries both lime and animal manure are cheaply obtained, and probably used with profit. As often as lime is used, animal manure can be also applied to counteract the loss of organic matter induced

Under Australian conditions, however, animal manure cannot be obtained in sufficient quantity for much more than vegetable growing. In this branch of farming liming is probably of value. In extensive farming, however, the use of animal manure in sufficient quantity is mostly out of the question, and manuring cannot follow liming to the extent that is necessary to counteract the exhausting effect on the organic matter.

Because of this effect of lime on the organic matter of the soil then, care must be exercised in recommending its use in extensive methods of farming.

Does Liming Pay for its Cost?

In America, lime can be obtained for something like 5s. per ton, whereas in Australia the cost of agricultural lime landed on the farm is £3 or £4 or more per ton. The application of ½ to 1 ton per acre (the usual recommendation of agricultural chemists) is obviously impossible on a 600-acre wheat farm, for no matter what the object of applying it might be, there is

too great an addition to the capital cost compared with the normal value of the land for the wheat-growing industry to make the interest on. Further, some experiments which have been carried out with wheat on limed soil in New South Wales have failed to give more than a bushel increase, and in some cases the yield has been decreased by liming.

With maize, the effect of liming in New South Wales has been to decrease rather than increase the yield under extensive farming conditions, and the results of liming lucerne and potatoes have also been disappointing in this State.

Thus with our main crops in Australia the application of lime is not beneficial, and is apparently unprofitable, and it probably should be used with caution on other crops.

The statement is often made that lime will kill out or keep down sorrel, and that this weed is an indication of sour land which needs sweetening with lime. In the New England district of New South Wales in 1921, after an abnormally heavy winter rainfall, a good part of the country presented the appearance of a "red sea" of sorrel on poor soil and on good, rich, well drained soil alike, on which lime had no effect beyond showing a markedly increased growth. This winter was fortunately followed by a dry summer which enabled farmers to get rid of the sorrel by cultivation without the so-called "aid" of lime.

After all, it is on the profitableness of the application of lime in any circumstance that the soundness of the advice must depend, and though hundreds of tons of lime have probably been applied to soils in Australia on the advice of chemists, not a single instance is known where the application has been shown to be a profitable transaction for the farmer on rock-derived soils.

Sweetening Sour or Acid Soils with Lime.

On soils of peat or swamp formation liming may be absolutely necessary, but on rock-derived soils it cannot be dogmatised that liming is necessary merely because the soil gives an acid reaction or because it is found to have indicated a certain lime-requirement by chemical methods in the laboratory.

The recommendations of agricultural chemists to neutralise these soils by liming are open to characterisation of pure empiricism, especially since probably 90 or 95 per cent. of the cultivated rock-derived soils of Australia have an acid reaction and have not been found to have been farmed more profitably when neutralised by liming. As a matter of fact soils may be sufficiently acid to affect the growth of bacteria, but this may not be of any direct detriment to higher plant life.

Moreover, frequent instances are known in which crops on acid soils have been found to be markedly benefited by the application of an acid fertiliser like superphosphate. On the Dorrigo Tableland in New South Wales, where the annual rainfall is over 70 inches, on a strongly acid basaltic soil which had been under cultivation many years and from which considerable lime may have been expected to have been leached, 2 cwt. superphosphate per acre gave a higher increase in the yield of maize than ½ ton lime.

It is also known that lime has the effect of encouraging the growth of clovers in a pasture, but it is open to question whether even on an acid soil an acid fertiliser like superphosphate will not cause a more marked increase in the growth of clovers in a pasture at far less expense than lime.

Chemists themselves are now questioning the power of litmus to determine acidity in any accurate degree (some calcareous soils have been found to be acid to litmus) and are turning to other empirical methods of determining soil acidity or the lime requirement of the soil. Some now measure the lime requirement by determining the percentage of lime present in the soil.

Does a Poor Lime Content Indicate Need for Liming?

The soils of Australia are generally poor in lime except in certain favoured localities, and this characteristic is very marked when our soils are compared with those of other countries.

It is generally accepted by agricultural chemists on the authority of Sir A. D. Hall, formerly Director of Rothamsted Experiment Station, now Secretary of the Board of Agriculture, England, that soils containing less than 1 per cent. of carbonate of lime require liming. This represents about ½ per cent. of lime (calcium oxide), and very few soils in Australia contain as much as this, the bulk of our soils containing considerably less.

In fact, only the limestone, most alluvial, and some basaltic soils of Australia contain more than ½ per cent. of lime, while some alluvial, many basaltic, practically all granite, and all shale, slate, and sandstone soils, fall into this class which require liming if we accept this authority.

It must be regarded as an unjustifiable assumption to apply this arbitrary figure to classify Australian soils. Sir A. D. Hall is so eminent an agricultural authority that we should not, perhaps, lightly dispute his statement, but it is thought that he would be the last person in the world to contend that this statement was meant to apply to Australian soils.

Is Lime needed for the Soil or for the Plant?

Nearly all agricultural chemists have undoubtedly emphasised the question of the lime requirement of the soil, and have entirely omitted any consideration or have given too little thought to the individual needs or whims of the crop which is to be grown on the soil. Although there is a difference of opinion in different countries on the subject, it is admitted generally that some plants benefit from liming while others are actually injured.

Experiments conducted in Rhode Island[1] (U.S.A.), over a period of twenty-two years on acid soil, showed that peanuts, maize, beans, cotton, cowpeas, flax, millet, rye, vetches, and some clovers, grew better when the soil was not limed than on the limed soil, while in the case of oats, peas, and wheat, a slight benefit was obtained from liming, and only barley, beets, onions, rape, and tobacco showed marked benefit from liming.

In Porto Rico[2] an excess of lime was found to be distinctly injurious to the pineapple crop.

[1] Rhode Island Agr. Coll. Bull., No. 160 (1914).
[2] Porto Rico Agr. Expt. Sta. Bull., No. 11 (1911).

Experiments carried out at the Agricultural Experiment Station of Liebefeld, Berne, Switzerland,[3] on a sandy loam soil poor in lime, showed that flax suffered in growth and yield in proportion to the amount of lime added to the soil.

These examples serve to show that the lime-requirement of the plant should be studied rather than or in addition to the so-called lime-requirement of the soil, and they indicate that the field experimentalist will have to be consulted rather than the agricultural chemist.

A list of crops responsive to lime and those injured by lime is required for Australian conditions.

New Zealand Experiments.

Under New Zealand conditions it is thought that the liming of soil will possibly be found to be more beneficial than in Australia, but it is pleasing to note that although liming has been generally advised by agricultural chemists, field experiments are being made to determine the profitableness or otherwise of the practice.

In one experiment reported by Greenwood[4] an analysis of the soil for the lime requirements was made by the Department's chemist, and it showed a deficiency of 2 tons 2 cwt. per acre. On a crop of rape the yield was increased by nearly 6 tons green fodder per acre, with the addition of 2 tons lime (crushed stone) per acre, but 11 and 14 tons increase in yield was made by the application of 2 cwt. superphosphate and 2 cwt. ground rock phosphate respectively, at far less cost. Where lime was applied in addition to the phosphate, it does not appear to have been profitable.

The same author[5] also reports the result of another experiment on pasture which shows practically no increase from liming at the rate of 1 ton ground carbonate per acre, while 2 cwt. superphosphate per acre gave an increase of 4½ tons per acre (green weight). Lime, in addition to phosphates, has not given sufficient increase in yield to pay for its cost.

A further experiment reported by Patterson[6] shows a very profitable increase for superphosphate alone, but practically no increase for lime in addition.

Schwass[7] reports the results of three years' work on pasture showing a net profit of £2 17s. 7d. from liming at the rate of 1 ton carbonate of lime per acre, and a profit of £4 7s. per acre from the application of 3 cwt. superphosphate per acre in addition to the lime. Unfortunately no plot with superphosphate alone was included in this experiment.

The results of these experiments indicate that even while agricultural chemists find a certain lime-requirement in soils in a laboratory test, even an acid fertiliser like superphosphate immediately gives substantially increased yields, which are much more profitable than liming alone or in

[3] Abstract in Internat. Review of Science and Practice of Agriculture, March, 1921.
[4] *New Zealand Journal of Agriculture*, April, 1922 (F. W. Greenwood).
[5] *New Zealand Journal of Agriculture*, March, 1922 (F. W. Greenwood).
[6] *New Zealand Journal of Agriculture*, May, 1922 (T. H. Patterson).
[7] *New Zealand Journal of Agriculture*, June, 1920 (C. H. Schwass).

addition. It is known that lime has the effect of increasing the growth of clover in the pasture, but superphosphate also possesses this virtue in a marked degree.

These experiments are as yet in their infancy and need to be further continued, but they should at least cause agricultural chemists to hesitate before recommending the application of lime as the result of a laboratory examination of the soil, and to have some regard for the farmer's pocket because of the doubtful profitableness of the operation.

On potatoes[8] an application of 3 tons limestone per acre on the Winton experiment area reduced the yield by half, and on lucerne a plot with inoculated soil was deemed to be of quite as good appearance as a plot treated with inoculated soil and, in addition, 1 ton burnt lime per acre.

Why is Liming Apparently Unprofitable in Australia?

In the first place it must be recognised that, owing to our extensive methods of farming, there is not the large amount of organic matter in the soil that obtains in other countries under intensive cultivation. Under the latter conditions circumstances must be made distinctly favourable for the organisms (this is done by liming) which break down organic matter and convert it into humus and plant food. With the smaller amount of organic matter in our soils, and in our warmer climate, decomposition of organic matter and nitrification take place so quickly that liming would be largely unnecessary to provide a suitable medium for the essential bacteria. In fact, under Australian conditions, particularly in warm climates, to prevent too rapid oxidation of the organic matter, it may be desirable to maintain a somewhat acid condition of the soil, for too favorable a condition for the bacteria induced by liming may too rapidly exhaust the organic matter.

The increased value of organic matter in lightening the texture of a stiff clay soil under Australian conditions may be explained by the same fact that with the rapid oxidation of the organic matter through ammonia compounds to nitrates these would at most times be a good percentage of ammonium carbonate in the soil which has as marked an effect in flocculating clay from a colloidal condition as has lime.

It appears, then, that many of the virtues of lime on the biological and physical character of the soil which are found in colder countries may be attributed to and performed best by the climate alone under Australian conditions

The markedly increased yields (up to 300 per cent. increase) obtained with superphosphate on lucerne in New England, one of the coldest parts of New South Wales, and the generally poor results from liming this crop, would also probably be obtained in New Zealand.

In so many cases has superphosphate given good results in Australia while liming has shown little or no benefit, that it seems first of all that our soils are generally so deficient in available phosphates that this is the limiting factor in production rather than an acid soil. The small amount of lime

[8] *New Zealand Journal of Agriculture,* October, 1921.

added to the soil in a few hundred pounds of superphosphate cannot be supposed to have a satisfying influence on the soil which chemists find to have a lime-requirement of tons per acre. In view of the apparent importance of phosphates, any experiments to determine the need for liming on a soil should be supplementary to its most profitable treatment with phosphates.

Conclusion

The laboratory determination of a soil's acidity or lime-content or requirement under Australian conditions must be regarded as purely academic, and the advice given on the need for liming on such examination is largely empirical—without any proved quantitative correlation with field practice and profitable agriculture by which farmers should be best guided.

The present position calls for caution on the part of the agricultural chemist in the indiscriminate theories and recommendations concerning the use of lime until more accurate data from field experiments (in which the cost of liming is considered) are available.

Prickly-pear as Fodder for Sheep.

According to Bulletin No. 4, 1922, of the South African Department of Agriculture, preliminary investigations at Grootfontein School of Agriculture as to the value of prickly-pear as a fodder for sheep have led to the following conclusions:—

1. We have found that sheep take prickly-pear readily—an average of over 12 lb. per day for over 250 days.
2. Sheep getting plenty of pear require no water to drink.
3. Prickly-pear alone is not a sufficient ration for the maintenance of *hamels* (wethers), much less for the maintenance of ewes in milk.
4. Prickly-pear is invaluable in times of drought, both as a source of water and of food.
5. Sheep can live at least 250 days on prickly-pear only, provided they are in good condition when the feeding begins, and provided they are in a normal state of health.
6. Prickly-pear is a valuable succulent roughage for sheep for fattening and production purposes in general, provided it is fed with protein-supplying foodstuffs as, for example, lucerne-hay.

The great objection to the use of the pest pear for feeding purposes is found to be the thorns, concerning which it is added that, although these are rendered relatively harmless when the "leaves" are chopped up, the singeing of the thorns, as practised in certain parts of America, suggests itself as a better method of preparing the pear as food for stock.

Plots that stand for Agricultural Progress.

Two hundred and forty-five farmers collaborated with the Department in experiments carried out on farmers' own plots during the year 1921-22. The total area under these experiments was 1,416 acres. The exact economic value of such co-operation is difficult to estimate—or over-estimate.—A. H. E. McDonald, Chief Inspector of Agriculture.

INVESTIGATIONS IN QUEENSLAND CONCERNING SHEEP BLOW-FLY.

THE first annual report of the Director of the Commonwealth Institute of Science and Industry contains the following account of the experimental work that has been carried out in Queensland:—

"(*a*) *Jetting.*—Many thousands of sheep were jetted during the year, and, owing to very bad and recurring fly attacks from the months of February to October, the protection was thoroughly tested. It was found to be nearly perfect, the losses through fly attack at Dalmally on the treated sheep being practically nil, while serious losses occurred at certain stations in the surrounding district where jetting was not practised. The solution is now made up by adding 2 lb. of soda ash to each 100 gallons of boiling water, and while still boiling adding from 7 to 10 lb. of arsenic and boiling until the arsenic is dissolved. This simple cheap formula has been found to give better results than any of the other mixtures tested.

"As a rule 7 lb. to 100 gallons or 0·7 per cent. of arsenic is enough. Fears of poisoning from the use of such a comparatively strong solution have been expressed, but so far not a single case of poisoning through jetting with arsenical solutions of such strength has been seen or reported, and the wool is not injured in any way.

"(*b*) *Dipping.*—The protection obtained in previous years by dipping with the shower dip was still found to be the most suitable and effective in the case of ewes in lamb, weak sheep, and those with six or more months' growth of wool. For other sheep a swim dip was built, and found to be preferable, being quicker. As it was found that dipping with the ordinary strength of 0·2 arsenic gave little protection from fly attack, the strength was gradually raised, and during the year many sheep have been put through the dip at a strength of 0·5 per cent. arsenic. This gave good protection from fly attack, and so far not a single case of arsenical poisoning has appeared. Owing to the weaker strength of arsenical solution which has to be used, dipping has not given so good a protection against fly attack as jetting, though it is necessary where protection is required for other parts of the body than the breach. Over 90 per cent. of fly attack is on the breach, however. Further experiments . . . are in progress.

"(*c*) *Jetting and Dressing with Oil Mixtures.*—Experiments in jetting and dressing with oil mixtures were continued during the year, but the apparently promising results obtained in the earlier experiments were not confirmed by the later experiments on a larger scale. . . .

"(*d*) *Dressing with Crude Fuel Oil.*—It was found that ordinary crude fuel oil is a very good dressing for rams' horns, preventing fly attack for a considerable time, and it has proved the most effective dressing of the many which the Committee has tried in the case of extensive lesions where dressings containing poison might be detrimental."

PROMISING NEW TYPES OF WHEAT.

THE most promising feature in the material now being handled consists of varieties resembling Yandilla King and Marshall's No. 3, but with grain showing qualities more or less like Hard Federation. These should be suitable for sowing early in the main wheat districts, being midseason varieties of the medium-hard class.—J. T. PRIDHAM, Plant Breeder, in a recent report.

Wheat Crop Competitions, 1922.

FORBES AND PARKES P. AND A. ASSOCIATIONS.

H. BARTLETT, Senior Agricultural Instructor.*

SITUATED a little east of the centre of New South Wales, distant 200 to 340 miles west of Sydney, are the districts known as the Central-western Slopes and Central-western Plains. The former at first slopes somewhat rapidly towards the west from the high spurs of the Great Dividing Range on the eastern boundary, the country being undulating to hilly until well within sight of Parkes and Wellington (where the elevation is approximately 1,000 feet as against 2,846 feet at Orange). There is then a slight and fairly constant fall westward and northward, with frequent hilly to mountainous outcrops, ultimately merging into the intermingled flat and undulating country of the second of the districts referred to—the Central-western Plains. Here the elevation is about 600 to 800 feet.

The chief timbers in this country are the many kinds of box, cyprus pine, kurrajong, myall, and wilga, all of which have their uses, and do not present difficulties when new land is being brought under cultivation. The rivers Castlereagh, Macquarie, Bogan, and Lachlan are worthy of mention as presenting opportunities for intensive irrigation farming along the river flats, and the progressive towns of Forbes, Parkes, Wellington, Dubbo, Gilgandra, Coonamble, Narromine, Nyngan, Trundle, and Condobolin indicate the agricultural and pastoral possibilities of the country when modern farming practices become generally adopted.

Water is obtainable over most of the area by boring to depths of 50 to 400 feet, and although in places it is somewhat alkaline, its use for stock purposes can generally be recommended. If water is not obtainable by boring, the contour and physical condition of the soils render possible the conservation of adequate water supplies by means of dams.

The soils vary from a red sandy loam to a rather heavy red to black clayey loam, enabling all preferences to be satisfied from a wheat-growing point of view, and (the subsoils being retentive) are typical of good wheat country.

The rainfall distribution is highly satisfactory for mixed farming (wheat and sheep), the winter rains being ample for crop growth, and the summer rains generally sufficient to promote grass and herbage for autumn lambing. The country adjacent to the Parkes to Condobolin railway line shares equally in the monsoonal summer rains and the antarctic winter rains, but variation from that equilibrium increases northward and southward of this

* With the permission of the Minister for Agriculture the services of Mr. Bartlett were made available to these associations in the capacity of judge.

line. Thus the proportion of summer rain increases as the distance from the line increases northward, while it is the winter rain that increases in proportion as the distance increases southward from the line. This is forcibly illustrated by rainfall records registered over a period of thirty-nine years. In the following table are compared the falls as registered at the chief centres during the winter or crop-growing period (May to October) and the summer or fallow period (November to April), the figures being averages of registrations over the period mentioned:—

	Winter (May—October) Rainfall.	Summer (Nov.-April) Rainfall	Total for the year	Difference in favour of Winter	Difference in favour of Summer
	inches.	inches.	inches.	inches.	inches.
Forbes	10·34	9·50	19·84	·84	..
Parkes	10·85	10·07	20·92	·78	
Condobolin	8·71	8·47	17·18	·24	
Dubbo	10·70	11·43	22·13		·73
Gilgandra	10·98	12·67	23·65	..	1·69
Nyngan	7·18	9·61	16·79	...	2·43

A 10-inch rainfall during the growing period is ample for the production of heavy wheat crops; it is only in the far western centres, such as Condobolin, that the registration is somewhat lighter; and experience has proved that with the adoption of fallowing and the judicious selection of varieties even so far west the country is suitable for successful wheat-growing.

All the country is more or less improved, having been rung, suckered, burnt, and fenced for grazing purposes, or more highly improved for agricultural uses. The present values range from £2 to £7 per acre.

Realising the assets which the country possesses—the right soil, adequate rainfall, railway transport, healthy climate, and cheap land—the more progressive farmers of the west are co-operating in a movement to stimulate settlement and increased production. Their aim is to raise the average acre yield of wheat, thereby attracting additional settlers to these favoured lands. Until such time as the average yield per acre of wheat is considerably increased above the 12-bushel mark, the popular impression will be that the western district is not suitable for profitable wheat-growing, whereas there are farmers who, following advanced methods, are able to harvest nine-bag crops with the aid of a light rainfall of 5½ inches during the growing period. If such methods are generally followed it will only be a matter of a few years when the whole of the western area, out as far as Condobolin, if, indeed, not further, will aptly be termed a safe wheat district. It is with a view to demonstrating the value of these methods and bringing about their more general adoption that agricultural associations throughout the west have promoted growing wheat—and in some cases fallowing—competitions, a movement to which the Royal Agricultural Society has given generous support.

*See *Agricultural Gazette*, August, 1922, p. 567, "The Value of Crop Competitions" and October, 1922, p. 714, "Western Wheat-growing Competitions."

The Contests

This year the Forbes Agricultural Association conducted its second crop competition and the Parkes Association its first, both being judged during the week 30th October to 4th November. Naturally, the crops submitted for inspection in a crop competition are the very best, the product of the careful thought and practice of probably the most progressive and able farmers of the district, and they are consequently far ahead of the district's average. The disparity, moreover, is emphasised by the fact that the nine-bag crop and the failure are often only separated by a fence. With a few exceptions the methods of crop production as followed by competitors in this year's contests, plus apparent improvement, are worthy of being followed by their immediate neighbours. The conditions during the whole of the year were "dry," yet the average yield of the competing crops should be between eight and nine bags per acre. Of the methods tending to success, this may be said: Although fallowing is the first word in successful wheat-growing, it is not the last; such factors as rotation of crops, manuring, selection of varieties, selection, grading, and pickling of seed and control of disease have a direct bearing upon ultimate results.

Wherever conditions made comparison possible, early ploughing of the fallows (July-August) proved the most effective. The average depth was about 4 inches, and deeper ploughing not only does not appear to be necessary, but in some cases seems likely to be harmful. The mouldboard plough is generally favoured, as the correct mulch is more easily maintained than when the disc plough is used.

Owing to the dry summer weed growth was light, and few cultivations were given, thus leaving the soil in a rather open condition to the ploughing depth, and failing to produce the nicely compacted sub-surface soil so essential for the rapid growth of the wheat seeding. A very satisfactory crop was produced on a fallow unworked until just prior to sowing, but the weed growth had several times been fed off rapidly with sheep—when the soil was sufficiently dry—which undoubtedly had the effect of compacting the sub-surface soil.

Flag smut, which was fairly prevalent in a few crops inspected, has considerably reduced the yield of many crops throughout the west during the present season, in some cases by as much as 30 per cent. The disease appears to affect all varieties, though Federation, Hard Federation, and Canberra seem to be most liable to attack. Foot-rot and take-all are undoubtedly spreading, and unless means are taken to reduce the diseases, losses are likely to be heavy in the near future. Most crops were free from bunt (smut), which is a tribute to the care exercised by competitors in relation to seed selection and pickling.

The weeds causing most trouble were found to be black oats, wild mustard, and barley grass. The autumn rains were insufficient to germinate weed seeds prior to sowing the early crops, and fallows once thought clean proved disappointingly dirty. The crops sown about the middle of May, however, after a cultivation destroying the weed seedlings, were fairly clean. Wild

mustard, which has been absent for some years, overran some of the district crops, and it is evident that the seeds are able to remain dormant for a considerable time.

A Striking Feature.

The most striking feature of the competitions has been the successful application of superphosphate. Prior to this year the economic use of superphosphate was questioned, although the Department's experiment plots had shown an average increase of approximately 2 bushels per acre; but the increased yields of field crops has this year been so marked as to leave no further cause for doubt. Cases where manured crops yielded nine bags and unmanured crops, under otherwise identical conditions, only three bags, were met with throughout the district. The heavier applications—up to 56 lb. per acre—gave the best results.

The extraordinarily beneficial effect of superphosphate may be attributed (1) to the increased root growth of the young plants, which enables them to make full use of the frequent but light showers of winter and thus to root more deeply, and (2) to the tendency of the crop when stimulated by this fertiliser to ripen earlier. The consequence is that the plants are in a better condition to withstand the dry weather of the spring months. In no case was the manure observed to induce "burning off" of the crop.

Although the results prove so definitely the advantage of applications of superphosphate, a note of caution, however, must be sounded, as a general increase above the 56-lb. mark may have a depressing result upon yields. The amount of fertiliser which may be to economical advantage depends upon the rainfall as well as upon the deficiency of plant-food, and as a general guide it may be said that the lighter the rainfall the lighter should be the applications. By exercising his own judgment the farmer may vary the amount according to the condition of the fallows, and the seasonal prospects. Provided the fallows have been well worked and contain a high percentage of moisture, and indications point to a good season, larger amounts may safely be applied. The condition to avoid is a succulent bulky crop, having little subsoil moisture to draw upon during the month of October. The manuring of stubble-sown crops will often prove disappointing for this very reason.

The value of the seed grader as an aid to keeping paddocks free from black oats and other weeds, and for the production of even strong crops is becoming generally recognised, and many who have tested its value by using their neighbours' machines are now purchasing their own plants.

The Question of Varieties.

There is a general tendency in the western district to discard the mid-season and later-maturing wheats, and to concentrate upon the quick-maturing varieties. This is certainly advisable in the far western centres, but in the Forbes and Parkes districts the midseason wheats cannot yet be wholly discarded, as wheats must here be sown in season. Of the crops inspected,

Hard Federation figured in twelve, Canberra in eleven, Federation in three, Improved Steinwedel in two, and Major, Turvey, Marshall's No. 3, and Roseworthy each in one, and the results of this year's competitions apparently justifies the tendency referred to; but the season was abnormal and particularly suited to varieties such as Canberra and Hard Federation. By delaying sowing operations till the middle of May, and using the quick maturing varieties, an opportunity is afforded to destroy the late autumn weed growth, which practice can be recommended, but as the large areas which are cropped compel sowing to commence in April, the midseason varieties, such as Marshall's No. 3, Yandilla King, and Federation, must then be sown.

Canberra is yielding far ahead of all other varieties, followed by Hard Federation, and it is pleasing to note that Federation is regaining its popularity, and will be in demand for next planting. As a general guide, the following varieties and period of sowing may be recommended:—

For April Sowing.—Marshall's No. 3, Yandilla King, followed by Federation, and small areas of Turvey, Major, and Warden.

For May-June Sowing.—Canberra, Hard Federation, and small areas of Gresley, Florence, and Improved Steinwedel.

The amount of graded seed sown varied between 40 and 56 lb. per acre, according to the variety and period of sowing. Lighter sowings, although sometimes giving satisfactory results, are not recommended, as very thin stands will result if germination is at all faulty.

The Season.

The rainfall from August, 1921, until October, 1922, proved somewhat below the average, except in December, when from 3 to 4 inches were registered. The light rainfall from January until April, 1922, somewhat lessened the value of the fallows, as it was difficult to obtain the right consolidation. Light showers during May were partly responsible for somewhat thin and patchy germination in certain centres, but, recurring at frequent intervals until August, proved sufficient for crop growth. From the beginning of September onwards almost droughty conditions prevailed, and, with a few exceptions, only the manured crops on fallowed land were able to mature full crops.

For purposes of comparing farming methods, the rainfall distribution has been divided into two portions—one being that for the fallowing period, August, 1921, to April, 1922, and the other for the growing period, May, 1922, to October, 1922. The rain registered during the growing period may not have actually fallen on the crop owing to late sowing, and the same applies to the fallow, but as the crop or the fallow actually benefited by contiguous falls the division made is correct for comparative purposes.

During the growing period the greatest deficiency occurred in the months of September and October, when the crops were at that stage of growth when an additional half-inch of rain would have made a difference of bags per acre in the yield.

District Rainfall Records.

Forbes.						Parkes.					
Fallowing Period.			Growing Period.			Fallowing Period.			Growing Period.		
—	Average of 39 years.	Fall in 1921–22.	—	Average of 39 years.	Fall in 1922.	—	Average of 39 years.	Fall in 1921–22.	—	Average of 39 years.	Fall in 1922.
1921.	Points.	Points.	1922.	Points.	Points.	1921.	Points.	Points.	1922.	Points.	Points.
Aug.	176	150	May	166	133	Aug.	192	201	May	165	138
Sept.	175	178	June	189	141	Sept.	170	175	June	219	155
Oct.	173	74	July	155	223	Oct.	159	73	July	180	229
Nov.	132	110	Aug.	176	139	Nov.	131	183	Aug.	192	168
Dec.	176	297	Sept.	175	72	Dec.	195	425	Sept.	170	87
1922			Oct.	173	93	1922			Oct.	159	89
Jan.	172	100				Jan.	216	97			
Feb.	154	39				Feb.	129	124			
March	167	Nil				March	184	10			
April	159	112				April	152	154			
Total	1,474	1,060	Total	1,034	801	Total	1,528	1,442	Total	1,065	859

The rainfall registered upon the property of each competitor, though the places were separated by only a few miles, varied considerably owing to storms:—

Competitor's Rainfall Records.

Name.	Fallow Period Aug., 1921–April 1922.	Growing Period May–October 1922.
Forbes District—	points.	points.
H. F. Sweeney	1,222	801
G. D. Bassett	1,060	801
M. W. Clements	1,222	707
W. E. J. Harrison	970	743
G. F. Sanderson	1,048	828
T. R. Sharp	1,094	761
Griffiths & Miller	1,222	707
Town of Forbes	1,069	801
Parkes District—		
A. Millgate	1,162	583
J. Aitken	1,442	859
A. Miller	1,236	810
W. J. Clark (approximate)	1,408	674
J. Hynes	1,319	748
W. E. Tayler	1,123	570
C. D. Houston	no record.	975
W. W. Watson	1,082	787
Skinner Bros.	1,442	859
J. Woods	1,162	583
P. Bourke	1,181	683
W. G. Blackstock	1,181	683
B. C. Adams	1,327	806
A. Warren	1,082	787
Bartlett Bros.	1,408	674
Town of Parkes	1,442	859

Cropping Details in Forbes Competition.

The winning crop was produced by Mr. H. F. Sweeney, Cherrytree Hill, Yamma, Forbes, and was grown upon fairly heavy red loam, box and pine country cleared twelve years ago, which has produced seven crops. The last crop was wheat in 1917, the paddock then being used for grazing purposes until September, 1921, when it was disc-ploughed; disc-cultivated in February, 1922, harrowed in April, and sown immediately afterwards, on 4th April, at the rate of 50 lb. of graded Federation seed, pickled in bluestone, and 45 lb. superphosphate per acre. The crop was true to type and pure, practically free from disease, clean, and well headed. This crop was grown within half a mile of the site producing the winning crop of the previous year's competition, and although such results demonstrate the high productive power of this type of country, due credit must be given to Mr. Sweeney for his careful farming.

Mr. G. D. Bassett, Old Anglesey, produced a very fine crop of Canberra upon slightly gravelly red loam country, which has been under cultivation for over forty years and has produced about thiry-five crops. The last

DETAILS of Award in the Forbes Competition.

Name	Yield	Type and Purity	Freedom from Disease	Evenness	Cleanliness	Condition and Appearance	Total
Maximum points	*	20	20	20	†	‡	
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
H. F. Sweeney	26	18	19	18	29	26	136
G. D. Bassett	29	20	17	16	26	26	134
M. W. Clements	30	15	19	18	23	27	132
W. E. J. Harrison	29	18	18	19	23	24	131
G. F. Sanderson	26	19	14	18	28	25	130
T. R. Sharp	18	17	19	18	27	25	124
Griffiths & Miller	21	14	12	16	18	25	106

* One point for each bushel of apparent yield.

† Maximum points, first crop, 24 points; second, 25 points; third, 26 points; fourth 27 points; fifth, 28 points; sixth, 29 points; over six crops, 30 points.

‡ Maximum points, first crop, 24 points; second, 25 points; third, 26 points; fourth 27 points; over four crops 28 points.

crop was cut for hay in 1920, the land being ploughed in July, 1921, with a mouldboard plough. It was spring-tooth cultivated in September, disc-cultivated in January, and sown with the combination drill during the first week in May, using 60 lb. of unpickled seed and from 40 to 60 lb. of superphosphate per acre. The crop was pure and true to type, somewhat uneven, and almost free from oats and undergrowth, but showed traces of flag smut and bunt. The crop was estimated to produce 29 bushels per acre, and of the portions manured with 60 and 40 lb. of superphosphate the difference in yield promised to be two bags in favour of the heavier dressing.

Mr. M. W. Clements, Glenisle, Orange-road, exhibited a heavy crop grown on a slope which has been cleared for nine years and which has produced seven crops. The crop on the higher and somewhat stony ground was particularly heavy and clean, but on the lower portions was much lighter and rather dirty, with wild mustard and oats. The weed growth was very disappointing to Mr. Clements, as he had gone to considerable trouble in keeping the fallow clean, but the absence of summer rains presented few opportunities for freeing the fallow from weed seeds. The previous crop was wheat in 1920, and the fallow was ploughed with the disc plough in June, 1921, spring-tooth cultivated three times in March, spring-toothed and harrowed in April, and sown with Hard Federation wheat during the third week of April, using 60 lb. of bluestoned seed and 30 lb. of superphosphate per acre. The weed growth during the summer months on the fallow was frequently grazed off with sheep.

The balance of the competitors submitted crops every one of which was grown upon more or less well-worked fallowed land to which, except in the case of the crop entered by Messrs. Griffiths and Miller, superphosphate had been applied. Certain crops were penalised in relation to the number of crops produced by the land, on the basis set down in the award.

Cropping Details in Parkes Competition.

An excellent crop of Canberra was exhibited by the winner, Mr. A. Millgate, Rockvale, Trundle-road. It was a crop difficult to fault, only dropping 4 points in a possible of 145. Such a high aggregate is only possible when strict attention is paid to the cropping system, working of fallows, selection and grading of seed, pickling and manuring. Although this was the fifteenth crop, not a sign of take-all, foot-rot, flag smut, or bunt was observed, no doubt owing to the fact that the two previous crops, in 1919 and 1920, had been oats. The soil is of red loam, and was ploughed with the mouldboard plough in September, 1921, spring-toothed in October and again in January, disc-cultivated in March, and spring-toothed in May, and was sown with 45 lb. of bluestone-pickled wheat and 56 lb. superphosphate per acre during the third week of May.

Mr. J. Aitken, Harrow Vale, entered a crop of Canberra which was remarkably even and free from disease, but was showing a slight variation of type, and was a little mixed; the presence of scattered oats and mustard caused the loss of 4 points. The crop was grown upon red loam box country, cleared many years ago, which has produced at least twenty crops, the last in 1920. The land was fallowed in July, 1921, with the mouldboard plough, spring-toothed in November, and again in February and May, and sown during the second week of May with 55 lb. of bluestone-pickled Canberra wheat and 56 lb. superphosphate per acre.

The heaviest crop in the competition was shown by Mr. A. Miller, Heatherleigh, Tichborne, but as it was only the fifth crop it was penalised 2 points. It was a crop of Marshall's No. 3, 4 feet in height, dense and even; it was almost free from disease, but showed a slight variation in type, was a little mixed, and slightly dirty with oats and mustard. It was

grown on fairly heavy red loam, which was cleared seven years ago, and has produced five crops. The fallow was disc-ploughed in August, 1921, spring-toothed in September and again in January, rolled in February, harrowed in March, spring-toothed in May, and sown with a disc drill during the first week of May at the rate of 55 lb. of graded seed pickled in bluestone and 45 lb. of superphosphate per acre.

DETAILS of Award in the Parkes Competition.

Name.	Yield.	Type and Purity.	Freedom from Disease.	Evenness.	Cleanliness.	Condition and Appearance.	Total.
Maximum points	*	20	20	20	†	‡	...
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	
A. Millgate	27	19	20	19	29	27	141
J. Aitken	30	15	20	20	26	27	138
A. Miller...	32	16	19	19	25	25	136
W. J. Clark	31	16	17	17	29	25	135
J. Hynes	25	19	16	19	29	27	135
W. E. Tayler	25	20	20	19	24	24	132
C. D. Houston	32	17	19	18	24	22	132
W. W. Watson	26	19	16	17	26	26	130
Skinner Bros.	25	16	15	19	29	26	130
J. Woods..	28	15	20	17	24	25	129
P. Bourke	25	18	18	17	23	25	126
W. G. Blackstock	24	16	19	17	24	24	124
B. C. Adams	27	17	18	16	19	26	123
A. Warren	25	17	17	18	24	22	123
Bartlett Bros.	21	17	19	17	24	23	121

* One point for each bushel of apparent yield.

† Maximum points, first crop, 24 points; second, 25 points; third, 26 points; fourth, 27 points; fifth, 28 points; sixth, 29 points; over six crops, 30 points.

‡ Maximum points, first crop, 24 points; second, 25 points; third, 26 points; fourth, 27 points; over four crops, 28 points.

An examination of the cropping details shows that ten crops were sown on fallow with superphosphate, two crops on fallow without superphosphate, two crops on stubble ploughed land with superphosphate, and one crop on stubble ploughed land without superphosphate.

As in the Forbes competition, certain crops were penalised in relation to the number of crops grown on the land.

In conclusion, I desire to commend the associations upon the success of the competitions, and also to thank the secretaries and members of the committees for their work and assistance in connection with the judging.

"I HAVE on hand a barrel of arsenate of lead which I purchased about seven years ago," wrote a correspondent recently. "It has never been opened, but it has dried up. Would it still be good to spray with?" The correspondent was informed that arsenate of lead should keep almost indefinitely if dry.

Kikuyu Grass in Bracken Fern Country.

J. N. WHITTET, Agrostologist.

It was pointed out in this *Gazette* in May, 1921, that Kikuyu grass should prove useful in assisting the control of bracken fern. Trials recently conducted in various parts of the State bear out the original contention regarding the smothering propensities of this grass, as the appended reports (confirming others already published) indicate.

Kikuyu Grass at Grafton.

In this area it is smothering paspalum and weed growth.

The fern country on which it is intended to grow Kikuyu, should be ploughed and worked prior to planting in the spring, or if the soil be of an open free nature the fern fronds should be cut in the early spring, burnt, and the grass roots hoed in. On large areas drills 3 feet apart should be struck out with a single furrow plough, the Kikuyu being dropped every 3 feet in the bottom of the drill, and covered with a light furrow, or by running a harrow along the drills in the direction in which they run. If the weather is at all favourable, the Kikuyu grass makes headway as soon as, or before, the fern, and by winter there is only sufficient fern showing to protect the grass from frost. By the following spring a mat of grass has formed over the blank spaces, and the fern is gradually choked out.

The illustration showing Kikuyu at Grafton conveys some idea of the vigour of this grass. This area, planted in September, 1921, was covered with a mass of weeds, paspalum, and fallen timber. The roots were hoed in approximately 3 feet apart each way, as it was impossible to work a plough or clean the land owing to the rubbish present, and since planting time the paddock has not been stocked in order that the Kikuyu could become well established. As the illustration shows, this grass is smothering out everything, and it has kept green right through the period of its growth - not having been cut back by frost, as was the case with paspalum. It appears practically certain that on the Northern Rivers it will withstand more frost and provide more succulent green feed during winter months than will paspalum.

Mr. J. H. Curran, Copeland, regarding Kikuyu grass, states: "In my opinion, it stands alone as a fodder grass. The plants supplied to me in September, 1920, have made great headway, and I split up the original plants in the spring of 1921 in order to plant out a larger area in bracken fern country. All the transplanted material did well, the grass growing to a height of 15 inches and sending out runners 7 to 9 feet in length.

Kikuyu has choked out the bracken fern on this plot.

"The fern country was planted after a fire, the grass being somewhat sheltered during the winter months by the fern, which grew again. The Kikuyu is making good headway now, and will eventually greatly assist in eradicating the pest. The frost cut back the surface growth of the grass in the open, but a nice green shoot was present where the fern sheltered it.

"I intend to plant more fern country this year, as I consider it will be a great boon to keep the stock among the fern, and so help to eradicate it, and at the same time have a crop of first-class feed in country which is practically useless as it now stands. When the fern is choked out by the grass, this country (which carried practically no feed where the weed is thick) will be most valuable grazing and dairying land.

"All my stock eat the grass greedily—in fact they prefer it to prairie grass. The altitude of this place is 2,700 feet, and, consequently, it is fairly cold."

Mr. G. Hilton, "Killarney," Lake Conjola, Milton, planted roots of Kikuyu in fern country in August, 1921. He reports:

"The roots struck a very dry spell just after planting, and practically no rain fell until Christmas. They are growing in black sandy soil, and were originally sown in drills 1 foot apart. Although the season was very dry the plants made rapid growth, and now a compact area of succulent feed, as shown in the accompanying photograph, which was taken in September of this year, is present. The growth made by the grass has smothered out all weeds; only an odd frond of bracken is showing through here and there.

"Kikuyu is certainly a most valuable grass for this class of soil and this locality; at the present time (31st August, 1922), the growth is high enough to cut with a scythe.

"I am also planting out Kikuyu grass between the rows of Elephant grass, which also grows well here. Elephant grass was grown in bracken fern and cutty grass and has killed them both. Frost does not affect either of these grasses, the winter here being very mild, owing to our close proximity to a large lake. I am highly pleased with both grasses."

Some Recent Publications.

Copies of the undermentioned Farmers' Bulletins may be obtained, at the prices indicated, from the Department of Agriculture, or from the Government Printer, Phillip-street, Sydney:—

- No. 137, Safeguarding Farm Stock from Disease. (Price 10d., post free.)
- No. 139, The Culture of Sugar Cane in New South Wales. (Price 10d., post free.)
- No. 140, The Pruning of the Vine. (Price 10d., post free.)
- No. 141, Cheesemaking on the Farm. (Price 1s. 1d., post free.)
- No. 143, Producing Lucerne Hay under Irrigation. (Price 10d., post free.)
- No. 144, Sheep-maggot Flies, No. 5. (Price 10d., post free.)

Maize Stover at Glen Innes.

An outstanding feature of the operations for the season 1921-22 at Glen Innes Experiment Farm was the success of shredded maize stover. Of excellent quality, it was eaten eagerly by stock. In spite of the good colour of the leaf, the cob matured well on the stalks, which were cut in the hard dough stage, apparently the best time for cutting. The machine used for shredding turns out a fodder that lends itself well to baling and transporting in time of scarcity.—From a recent report by Mr. R. H. Gennys.

Varieties of Maize in New South Wales.

[Continued from Vol. XXX, page 710.]

H. WENHOLZ, B.Sc. (Agr.), Special Agricultural Instructor.

Yellow Hogan.

NOTHING definite is known concerning the history of this variety, although it is supposed to be originally a selection of yellow seed from the variety Red Hogan. On some parts of the coast, however, the labelling of a variety as Hogan seems to be a local way out of the difficulty of naming any maize of which the name is not definitely known or is at least uncertain, so that no great reliance can be placed on the above supposition as to the origin of Yellow Hogan. This variety is nevertheless very largely grown on the Macleay River, and has also been seen to a lesser extent on the Hawkesbury and Shoalhaven Rivers. It has not many characters in common with the Large Red Hogan, from which it is supposed by some to be derived.

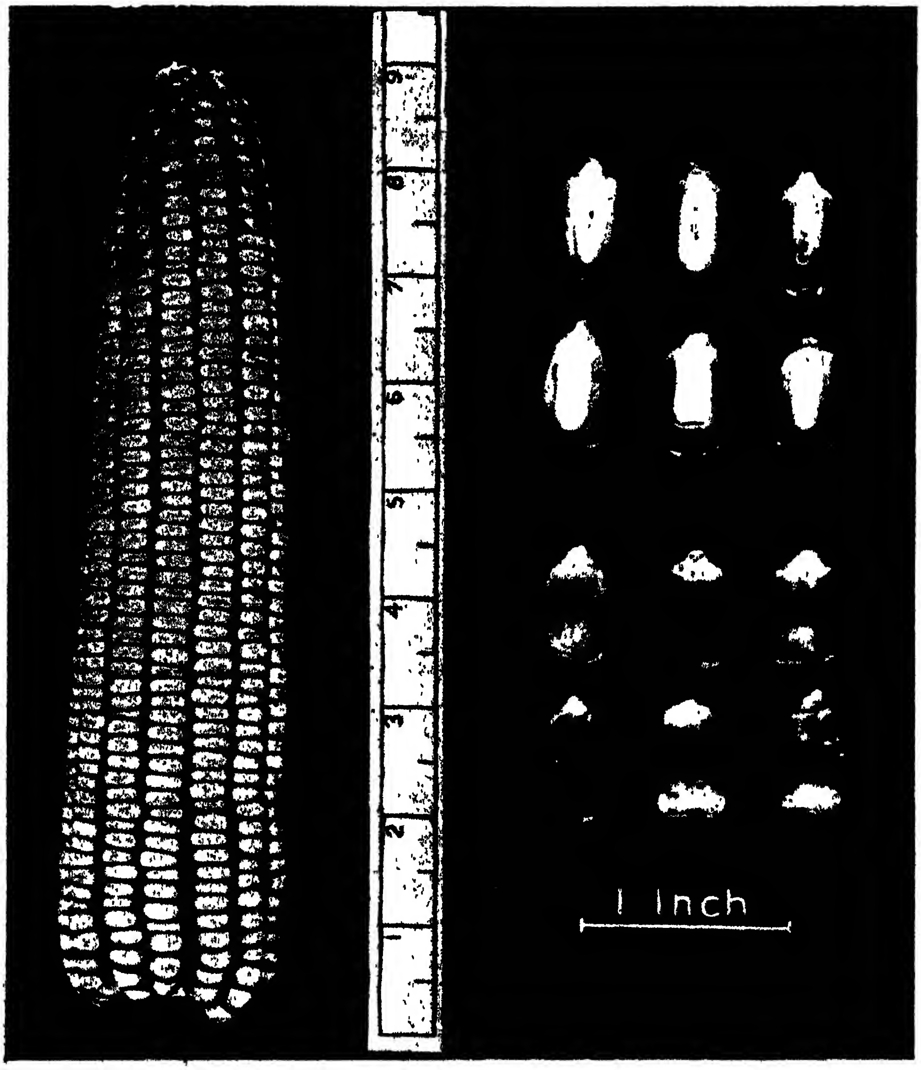
Yellow Hogan is a fairly late maturing variety, and, in consequence, grows a fairly tall stalk (which, however, is not very coarse), and the cobs are usually well covered with husk, probably as the result of many years' selection to naturally withstand the damage by weather and weevil. Early sowing is usually the practice on the Macleay and other rivers where this variety is grown, and in such crops weevil usually makes its appearance in the field before the crop is harvested. As the cobs usually infested with weevil are those which have not a good husk covering it is likely that continued selection of sound ears has made for a great improvement in the husk covering of this variety.

The cobs are not exceptionally long as a rule, about 8½ to 9½ inches being the standard size, and they are of rather small circumference. The shape is generally slowly tapering, and the variety is usually recognisable by the shallow, smooth, to very slightly roughened dent. Towards the tip of the ear the grains are scarcely dented at all, but bright, shiny, flinty, and rounded. The rows, usually straight and regular, vary from twelve to sixteen (more usually fourteen), and have medium wide furrows between them, which show up the colour of the grain. The butts are not usually well rounded, and the shank attachment is somewhat small.

The grain is of moderate breadth (about ⅜ inch, somewhat thin, and of only ordinary depth (about ½ inch). Owing to the tendency for the rows to be separated by fairly distinct furrows, the grain has a slightly rounded appearance on the sides. It is a fairly hard grain, of excellent colour and very bright appearance, with a large bright germ, and because it is so largely grown on the Macleay River this district has the reputation in the

Sydney market of producing the second finest quality sample of grain (next to Tumut district) in the State. It shells a good percentage of grain (better than most varieties), and has a fairly thin core.

Yellow Hogan is a late variety of maize, taking about six and a half months to mature on the coast, and is therefore likely to be suited only



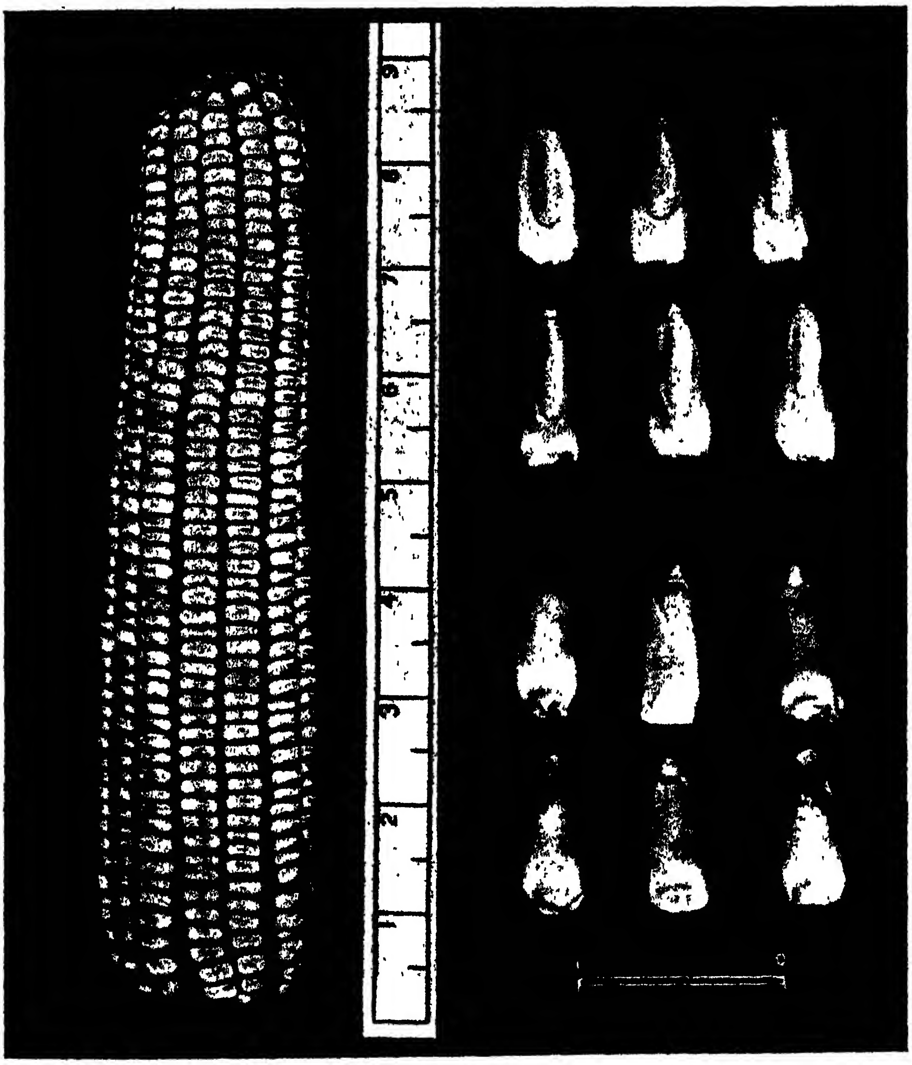
Yellow Hogan.

for the coastal districts. It is very extensively grown as the main crop variety on the Macleay River, to which district it is well suited. In the Macleay maize contest in 1921 it was entered by five farmers, and Mr. John Booth's seed of this variety was only beaten in yield by a non-competitive entry of Large Red Hogan. So far, Yellow Hogan has not compared favourably with other varieties north of the Nambucca River, but it is

promising on this river and also on the Manning, and is worthy of further trial on the Central and South Coast. It also seems as if this variety is more resistant to leaf blight than most, and it may therefore be sown in November and December with little risk of damage from this disease.

Manning Silvermine.

This variety has jumped into prominence as the result of the maize yield contests on the Manning River, where it has been performing creditably.



Manning Silvermine.

It has been known locally as Silvermine, but as it varies a good deal from the original or Iowa Silvermine, it was decided to name it Manning Silvermine in order to distinguish it. It is undoubtedly a definite variety of probably purely local origin. To the writer it appears to be the result of a

cross between Iowa Silvermine and Manning or Giant White. It has the long narrow cob with the fairly deep grain and small core of Iowa Silvermine (the grain being usually even deeper), and the fairly open furrows between the rows characteristic of Giant White, and in maturity it is about the same as Giant White, and cannot therefore be called an early variety, such as Iowa Silvermine is.

Manning Silvermine is not grown to any extent outside the Manning River district, where some farmers swear by it, and, as judged by the results it has given to date in the yield contests, there certainly seems to be some justification for these farmers favouring the variety. As previously stated, it is not an early variety, taking about five and three-quarter months to mature, but it is certainly earlier than the late-maturing varieties with which it does well to compare in yield.

The stalks grow fairly tall, much taller than the true Iowa Silvermine, but it has other characteristics in common with this variety, such as the tendency to produce two ears per stalk (especially under good conditions) and fairly long shanks, which enable the ears to droop at maturity. The husk covering is fairly good.

The cobs are fairly long and narrow, generally of cylindrical shape, and with twelve to fourteen straight regular rows of grain, with fairly open furrows between the rows, and a tendency to run in noticeable pairs. The dent is rough to pinched, with sometimes a definitely beaked upper edge.

The grain, like that of Iowa Silvermine, is fairly narrow, but it is much deeper, having a depth of $\frac{5}{8}$ to nearly $\frac{3}{4}$ inch, and fairly thin. It is somewhat soft and starchy in character, and the cobs have a small core.

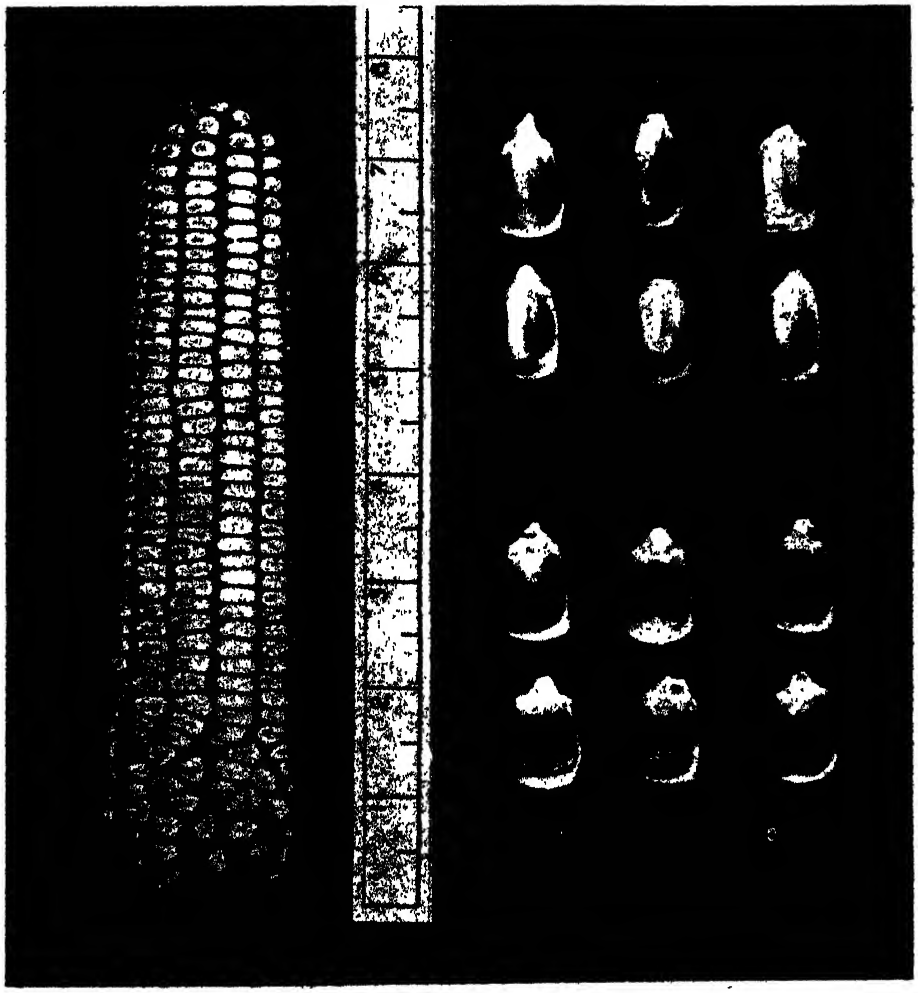
The variety is not as well fixed in type as other varieties, as might be expected from its suggested origin. It gained second place in the yield contest on the Manning River in 1921, and apparently does better on the lower part of this river and on the Macleay than on the upper portion, where the rainfall is less. It does not seem to be very resistant to leaf blight, and is therefore best sown early.

Golden Superb.

Golden Superb is a variety of maize which has been grown on the Macleay River as an early variety for very many years for early sowing, partly to catch the higher prices of the early market and partly to come off the ground early, especially where the land is low-lying and where heavy autumn rains or floods might render the harvesting of a late-maturing variety difficult or impossible. It occupies the same position on the Macleay as the favourite early variety as Leaming (which is of mid-season maturity) holds on the Clarence.

It is believed that Golden Superb originally came from America (although it does not seem to be grown there to any extent now), and that it was a pale golden coloured grain. As now grown on the Macleay, however, the grain nearly always has a fairly large amount of reddish colour through it, and even when devoid of this red colour it is of a much darker yellow or amber colour than it apparently was originally.

The variety is of early maturity, and the stalk growth is small. The young growth, especially the seedling, is exceptionally vigorous and sturdy. The ears are placed fairly low on the stalk, and are usually borne on a thin shank, making pulling an easy operation. The ears are only fairly covered with husk, and, owing to the earliness of the variety and the early

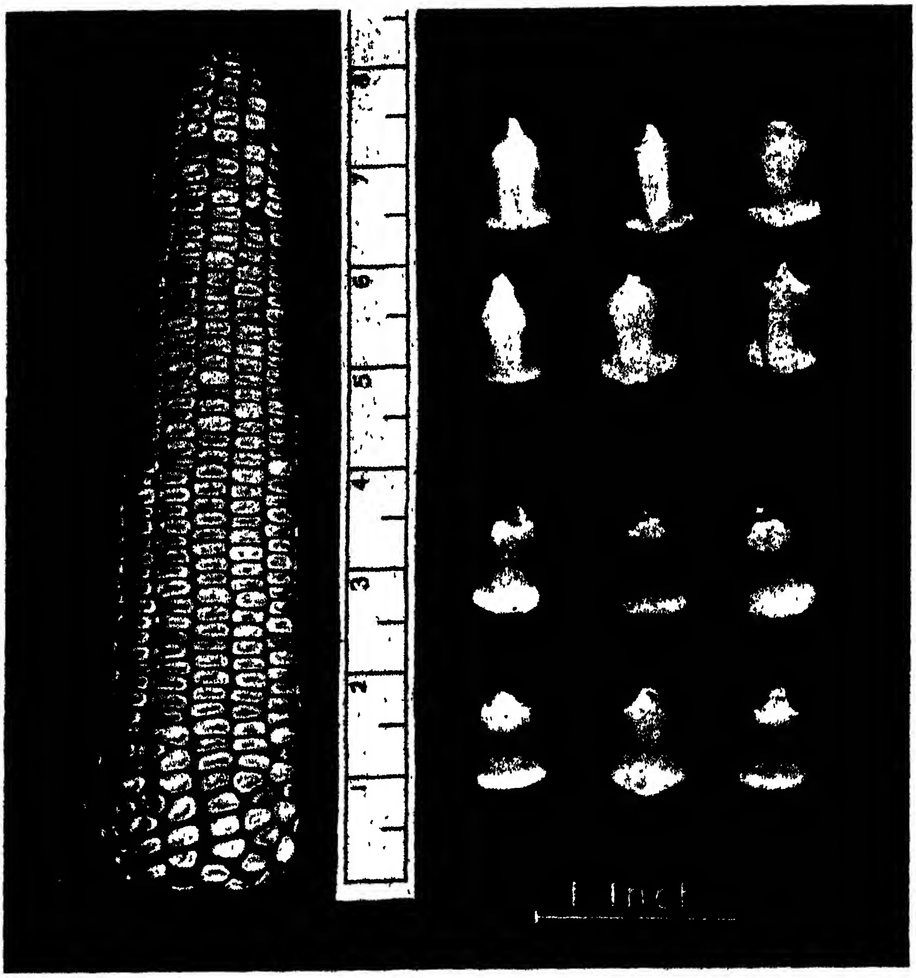


Golden Superb.

date at which it is usually sown, weevils generally make their appearance in the field before harvest. The keeping of seed, therefore, becomes difficult if special means of protection or prevention of damage are not employed.

The cobs are small, about 7 or 8 inches long, slightly tapering in shape, and of small circumference. They have ten to fourteen rows of grain (usually twelve), with medium narrow furrows between the rows. The dent is shallow and smooth—never rough or pinched. The grain is of moderate width, short (about ½ inch in depth), and medium thick, of dark amber or

reddish colour with a pale-coloured, almost whitish, cap, which latter serves to give this variety a distinctive appearance. The grain is fairly hard, and on this account it is not liked too well on the Upper Manning River, where kiln-drying is practised with early-maturing maize, as the grain becomes objectionably hard. This character, however, is not likely to cause the variety to be displaced from the Macleay River.



Golden Glow.

Golden Superb matures on the coast in four and a quarter to four and a half months, and it is most largely grown on the Macleay River, though it is also grown to some extent on the Upper Manning. Outside these rivers it is scarcely known. Experiments conducted by the Department show that this variety is one of the best yielding varieties as a main crop on the Coastal Tablelands (Dorrigo and Comboyne), and is also giving promise on parts of the Northern Tableland, also as a main crop variety. Insufficient tests have been made as yet to say whether it is better than other early

varieties on the coast, but it has such a firm hold on the Macleay that it will not easily be displaced, except by a vastly superior early variety of similar maturity.

One factor in its favour is its ability to resist leaf blight much better than many other early varieties when sown late. On this account it can be sown in December or January with a chance of getting a good crop, and, above all, of producing a good quality of seed. This valuable characteristic is wanting in several other early varieties, and it is chiefly due to its marked blight resistance that it succeeds so well in a district of such heavy rainfall as the Dorrigo.

Golden Glow.

Golden Glow was introduced by the Department of Agriculture from Wisconsin (U.S.A.) about 1918 as an early variety of high repute in that country, and was immediately put to trial in the tableland districts of New South Wales, where it has made good. It is not yet sufficiently known to be largely grown, but it is certain to displace in time some of the varieties which are grown on the tablelands at present. This variety may be classed as one of very early maturity, and grows only a short stalk. On appearance it seems to be essentially a grain variety, and would be easily surpassed in fodder yield by other varieties.

The cob is small (about 8 inches long), slightly tapering in shape, and of moderate thickness. The dent is shallow and smooth or slightly roughened. There are about fourteen or sixteen fairly regular rows of grain, with very narrow furrows separating them. The grain may be classed as small; it is about $\frac{7}{16}$ to $\frac{1}{2}$ inch deep, about $\frac{3}{8}$ inch broad, and of medium thickness. It is of good amber colour, very bright and attractive in appearance, and of moderate hardness. The core is of medium thickness.

Golden Glow matures about a fortnight or so earlier than any dent variety of maize previously known in this State. Under quick-growing conditions it would mature in about four months, but takes a few weeks longer in the cold climates, for which it is apparently best suited. It has been fairly successful on the Northern Tableland, not only in the recognised maize districts, but also in the colder potato districts, where little maize is at present grown. It has also done well on the Central and Southern Tablelands.

(*To be continued.*)

Sudan Grass in the Bathurst District.

In rate-of-seeding experiments with Sudan grass, now carried out for three years at Bathurst Experiment Farm, the best results have been those obtained from plots sown with the wheat drill at the rate of 10 lb. per acre, in rows 14 inches apart. It is now generally recognised that this distance is the best at which to sow this crop locally, though where the area is kept cultivated wider spacing (up to 3 feet apart) gives the heavier yield in the second and subsequent cuttings.—R. G. May, Manager, Bathurst Experiment Farm

"Pigs and their Management."

It is some twelve years since the first appearance of Mr. H. W. Potts' work with the above title. At that time Mr. Potts was the Principal of Hawkesbury Agricultural College, and the book, which was issued under the auspices of the Department of Agriculture, quickly commended itself to farmers for the practical way in which it dealt with the subject. Since then it has gone through three editions in all, and the total impressions have run to several thousands—a sufficient testimony to the real utility of the book.

Upon the retirement of Mr. Potts from the service of the Department, permission was given by the Minister of the day for the publication of the work as a private one, and we now have before us the fourth edition, dated 1923, and enlarged to 250 pages or more.

How profitable are the stock with which Mr. Potts deals hardly needs to be remarked. No other class of farm animal multiplies so rapidly, matures so quickly, and produces so much digestible flesh. The surprise is that pigs should be neglected by so many farmers, especially when the low cost of their food, and the ease with which successive litters may be raised and marketed, come to be considered. On the other hand, a scrutiny of the prospects of the industry is reassuring. Throughout the world there is an unlimited and expanding market for all pig products, and there is no reason why Australia should not exploit a share of it to her own advantage. At the very foundation of the business lies good breeding, and close to it good rearing methods. "Unless pigs are well cared for, suitably handled, properly fed, and improved strains of blood constantly introduced, they rapidly deteriorate." These are the subjects that occupy this valuable work, and upon which the author affords an abundance of information with a conviction and freedom of style that make the book easy reading

Feeding occupies over 80 pages, the cultivation of quite a number of useful crops being discussed at some length. The various breeds, sanitation, housing, slaughtering, bacon-curing, and a score of other aspects of the matter are all dwelt upon, the result being a book that the farmer will always find well worth its place in his bookcase.

Our copy from the publishers, Angus and Robertson, Ltd., Castlereagh street, Sydney.

Damage Caused by Weasels.

The contention by Mr. W. W. Froggatt, Government Entomologist,* that the introduction of weasels and stoats for the purpose of eradicating the rabbit would be attended by grave and unjustifiable risk to desirable forms of animal life, finds support in a paragraph that appeared in a recent issue of the Christchurch (New Zealand) *Press*:—

"Poultry-keepers in the Lake Brunner district are complaining bitterly of the depredations of weasels among their flocks, and a number of serious losses are reported. The weasels, having now practically exterminated the native ground birds, and increased their own numbers enormously, appear to have become emboldened, venturing even in daylight into fowl-yards, and there appears to be no means available of coping with the pest."

* *Agricultural Gazette*, June, 1922, p. 247; "Weasels and Stoats: the so-called Natural Enemies of Rabbits."

Making Use of Grain on the Farm.

J. T. PRIDHAM, Plant Breeder.

THE object of the following notes is to draw attention to the advantage of having a grinding mill on any farm on which wheat and oats are produced, and to the way in which the use of such a mill tends toward domestic and farm economy The mill may be of any convenient capacity, from a hand-power or horse-worked sort to an engine-driven type.

First, as to the household value of such an accessory as a means of producing whole-wheat flour or fine meal. That bread made from such flour has very distinct health-giving properties is well known. The home-ground article is especially to be recommended—the objection to bought wheat meal, either for bread or porridge making, is that it is frequently the product of the wrong class of grain. The grain should be of the hard variety, and it is a good plan for farmers who wish to grind a certain amount of grain for domestic use, and for the feeding of pigs and poultry, to sow a small area to a hard variety just for the purpose. The meal from such a variety (say Hard Federation or Florence) makes much the better bread; grains from some of the soft wheats grown in this State are more suited to the making of biscuits or boiled puddings Hard wheat, too, either by itself or mixed with rolled oats, makes the best porridge, but for this purpose the wheat need not be nearly so finely ground as for bread. For porridge it is advisable to soak it for twelve to twenty-four hours in salted water before cooking.

The natives of India and Asia Minor know the value of hard wheat, using it for home consumption and exporting the softer varieties. Hard wheat is less subject to attack by weevil when stored than soft, and there is no difficulty about keeping the grain for twelve months on the farm in a clean bin, replacing it each year when the fresh grain comes in. Naphthalene must not be put with wheat intended for human consumption, as its taste is very hard to get rid of. Two grindings are necessary in the case of most mills, to reduce the wheat to the requisite degree of fineness. A good plan is to put the first milling through a sieve, crushing the coarser particles again.

Curiously enough, city people are more keenly desirous of obtaining whole wheat for household consumption than growers themselves. Meal of this class is very much more than a mere fad—it may be regarded as a necessary commodity for growing children as well as for adults. The writer knows a family in which the bread eaten is entirely brown bread—bought brown bread, an article not nearly so palatable as the home-baked loaf from the home-ground meal would be; yet the children prefer it to the white. Such bread keeps the teeth clean, and, in the case of a nomally constituted person, aids digestion. The purchased article, however, is often made from flour

that has not been finely enough ground, and a person with a weak stomach would need to vary it with a proportion of white bread. Brown bread contains more protein than white, so that its substitution in the diet for white bread means that less meat is required—a point that is worth considering in our warm climate.

To make a well-risen loaf from whole-meal flour it is advisable to use equal quantities of this and of ordinary white flour. When yeast is not used the following recipe will be found very satisfactory.—Two cups white flour, two cups whole-meal flour, one teaspoonful salt, one teaspoonful baking-powder, two teaspoonfuls cream of tartar, one tablespoonful treacle dissolved in a cup of hot water. Mix all the dry ingredients, add a cup of milk to the hot water and treacle, and mix the whole to a soft dough. Put in a billy can, fit the lid on, and bake in a moderate oven for about an hour, making sure that the centre is cooked.

The late Mr. Farrar was much interested in macaroni, and strongly favoured its extensive use. Ordinary hard wheat makes satisfactory macaroni, and is used for the purpose by manufacturers in this State; but while this is a most nutritious food it lacks the mineral and peristaltic properties of whole wheat meal or flour.

It should be pointed out that the modern flour mills (fitted with rollers) are unable to turn out proper whole-wheat flour. The old stone mill makes the best product, but any farmer with a good crushing and grinding mill can make his own meal and flour, needing only a proportion of white flour for bread-making.

The use of a grinding mill on the farm constitutes an economy quite apart from the household. Peas, barley, sorghum and maize may be ground as well as wheat and oats, and the product utilised for the feeding of farm stock.

If the farm is to be kept free from oats in the crops it will be necessary to feed wheaten hay and crushed oats to the working horses. This is a good working ration that is much relished. By the use of crushed oats or maize, a smaller feed of chaff may be fed—which represents another advantage, for a horse's stomach is small, and the animal cannot make use of roughage as a cow can and does not need a very bulky ration.

The product of the grinding mill is of significance in the feeding of pigs and poultry, too. Any sort of wheat is good feed for this class of stock, but for egg production hens will do far better on hard grain, which contains more albumen-forming material than soft grain. In the case of pigs it is sometimes supposed that boiled whole wheat is a satisfactory ration, but the pig's anatomy is not unlike our own, and anybody who has tried boiled whole wheat for a breakfast dish is aware that to masticate it is like chewing pellets of rubber. The pig eats his breakfast very quickly, and the boiled wheat does him very little good when bolted with the swill of the trough. If ground, however, wheat is a satisfactory feed, either boiled or raw.

Of the value of crushed oats as a milk-producing ration for cows it is hardly necessary to speak.

Lucerne Top-dressing Experiments.

FIVE YEARS' TRIALS AT GLEN INNES EXPERIMENT FARM.

L. G. LITTLE, Experimentalist.

LUCERNE is not very largely grown in the Glen Innes district, farm practice being chiefly concerned with the production of cereals. Nor can the growth of lucerne here be compared with that of warmer districts (such as Tamworth or Inverell), but its behaviour has nevertheless indicated possibilities which seem to justify its general cultivation on a small scale.

Lucerne grows through the summer almost as vigorously as the clovers and withstands frost equally well, thus showing its adaptability to the climatic conditions. Its habit of growth excludes weeds, the paddock usually being very clean, its longevity makes it suitable for planting in odd corners, and it makes an excellent early spring growth, which, on one property adjoining the Experiment Farm, is regularly and very profitably used for the pasturing of lambing ewes. Although experiment has proved that lucerne will not stand pasturing conditions for more than a few years, one paddock on this farm, under conditions of ordinary harvesting, has lasted from 1907 to 1921. It was on this area—Paddock 18c, consisting of black clayey upland soil of basaltic origin, with a gentle slope to the north and fair drainage—that the experiments were conducted.

Certain trials conducted in the seasons 1913 to 1915 indicated the value of top-dressing, and in 1916 a new series of trials was started. In these experiments the areas were each one-twenty-fifth of an acre, the soil having a reddish tinge. The fertilisers were applied with the grain and fertiliser drill, the cost of actual application being about 2s. per acre in addition to the cost of fertiliser, as shown in the appended table. Harvesting was done with the ordinary mower, the plots being raked up and weighed immediately after cutting.

The effect of the fertilisers over several seasons has been most marked. To-day the top-dressed plots are stronger and freer from weeds, and they invariably make a doubly vigorous growth in early spring as compared with the untreated plots. The results show conclusively the soundness of the practice of top-dressing for lucerne in the Glen Innes district. The difference is so great that whereas lucerne is grown but little in the district at present, with systematic top-dressings the sphere of usefulness of the crop should be appreciably increased.

This stimulation of the early spring growth is an important factor, inasmuch as this growth is available for lambing ewes, and a good start for lambs may be assured by the sacrifice of the first cut. The heavier dressings gave the greatest immediate increase, but in later seasons this advantage

has not been maintained. This may be taken as an indication that 1 cwt. of superphosphate per acre per annum is sufficient for the crop's needs, after, say, an initial heavy dressing.

The influence of the sulphate of potash seems to point to the need of this element in the fertiliser requirements of lucerne. It must be noted that the averages are very considerably influenced by the yields from the first two seasons, when the effects of the application of the fertilisers to an impoverished area might be expected to reach their maximum.

The yields are interesting as a record of the production of lucerne over the five-year period. The rainfall needed for maximum results appears to be in the vicinity of 30 inches for the nine months concerned. In a good season the top-dressed plots have given their best results, while in the driest year they gave the only decreases recorded.

RAINFALL and Harvesting Particulars.

Year.	September	October.	November.	December.	January	February.	March.	April.	Total	Dates harvested	Remarks
	Pts.	Pts.	Pts.	Pts.	Pts	Pts	Pts.	Pts.	Pts.		
1916–17. (Fertiliser applied 1st September, 1916.)	150	223	494	670	722	421	93	12	2,785	First cut, 15th Nov., 1916; second, 6th Jan., 1917; third, 16th Feb., 1919. Small fourth growth.	Wet preceding winter.
1917–18. (Fertiliser applied 10th August, 1917.)	472	309	818	492	611	66	123	185	3,076	First cut, 22nd Oct., 1917; second, 5th Dec., 1917; third, 28th Jan., 1918; fourth, 9th April, 1918.	Dry winter.
1918–19. (Fertiliser applied 27th August, 1918.)	71	184	228	227	191	253	245	82	1,481	First cut, 16th Jan., 1919; second, 11th April, 1919.	Dry winter.
1919–20. (Fertiliser applied 20th August, 1918.)	42	126	124	372	654	113	143	186	1,760	One cut, 3rd Jan., 1920	Dry winter.
1920–21. (Fertiliser applied 28th August, 1920.)	361	225	251	349	150	171	456	187	2,150	First cut, 28th Oct., 1920; second, 31st Dec., 1920	Wet winter.

AVERAGE Yields in Terms of Hay.

Fertiliser per Acre.	Yield per Acre.			Increase			Value of Increase			*Cost of Increase.			Nett Gain.		
	t.	c.	qr.		c.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
2 cwt. superphosphate ...	1	17	1	1	2	0	3	17	0	0	14	0	3	3	0
1 cwt. superphosphate and ½ cwt. sulphate of potash.	1	18	0	1	2	3	4	0	0	1	5	0	2	15	0
1 cwt. superphosphate and 28 lb. sulphate of potash.	1	15	3	1	0	2	3	12	0	0	16	0	2	16	0
1 cwt. superphosphate ..	1	8	3	0	13	2	2	7	0	0	7	0	2	0	0
No fertiliser	0	15	1	....			....			....			......		

* In these computations superphosphate is valued at 7s. per cwt., sulphate of potash at 36s. per cwt., and hay at £3 10s. per ton.

Field Experiments with Winter Fodders.

GRAFTON EXPERIMENT FARM.

R. G. DOWNING, B.Sc. (Agr.), Senior Experimentalist.

THE North Coast may be termed "summer country"—that is to say, although there is normally a green shoot in the pastures during the winter, they do not attain their normal carrying capacity until late spring. In order to tide him over the time of scarcity from mid-winter to mid-spring, therefore, the more progressive North Coast dairy-farmer recognises the necessity of growing winter fodders; but although the practice is spreading, it is not by any means so general as it should be. Particularly is this to be wondered at when one considers the regularity with which this lean time arrives, and how invariably it is the men who prepare for it with thoroughness, who receive the big cheques, while those whose attitude is one of happy-go-lucky carelessness are "left."

For many years tests have been carried out at Grafton Experiment Farm with the object of determining which crop or combination of crops gives the most satisfactory results in this connection. Early in the trials it was conclusively demonstrated that winter cereals, either singly or in combination with legumes such as peas or vetches, give the highest yields. The disadvantages of crops such as wheat, barley, and oats are that in certain seasons they are very rust-liable, with a consequent diminution in yields, so that of recent years the trials have for the most part consisted of comparisons as regards rust-resistance of different varieties of these cereals.

The varieties tested were (oats) Guyra, Sunrise, Ruakura, and Algerian; (wheat) Thew, Marshall's No. 3, Huguenot, Cleveland, Warren, Firbank, and Clarendon; (barley) Cape and Skinless. Combinations of peas or vetches with these cereals have also been tried.

The soil on which these trials were carried out is second-class alluvial, typical of a wide area in the district. Planting has normally been carried out in March, and the rate of seeding has been as follows:—Oats alone, 58 lb. per acre; oats in combination with legumes, 36 lb.; wheat in combination with legumes, 30 lb.; vetches in combination with cereals, 30 lb.: field peas in combination with cereals, 30 lb. Harvesting was usually carried out about the middle of August, at which time feed is as a rule required most.

Without going into details of the yields over a long period, the results may be summarised as follows:—

1.—Sunrise oats and vetches or peas have been found the most satisfactory combination for winter feed.

2.—Oats have been found to give an increase, varying between 2 tons and 5 tons per acre, over an average yield of about 10 tons per acre for wheat.

3.—The inclusion of vetches or peas with the oats, besides giving a better balanced and more palatable ration, has resulted in an increased yield of upwards of about 2 tons over oats alone.

4.—Sunrise oats, by reason of its earliness, has been found to give a bigger bulk of fodder at the time it is most needed, although other varieties, such as Ruakura and Guyra, may later in the season exceed it in yield.

5.—Vetches and peas give about the same results when averaged over a period of years in combination with the cereals.

6.—Barley makes too slow a growth compared with oats or wheat, and consequently does not give the yield of the latter.

Of recent years the varieties of oats tested have been narrowed down to those mentioned above, while the varieties of wheat have been narrowed down to Thew, Warren, and Clarendon. Owing to its rust-escaping habit, the most suitable of these is Thew, followed by Warren. Seed of these varieties is, however, difficult to obtain, since they are not heavy grain yielders, and wheat-farmers do not grow them to any extent. Clarendon is early, fairly rust-escaping, and very little inferior in yield to the above varieties, while it is becoming more and more extensively grown in certain of our wheat districts, so that seed should be easily secured.

A point worth stressing with regard to the growing of winter fodders for dairy cattle is that, since the cereals tend to diminish in succulence very quickly after reaching their maximum development, it is preferable to grow, say, two varieties of oats and a wheat, rather than to sow the whole area to be cropped with one variety. By this means one ensures a supply of succulent feed over the period when most needed, instead of a fodder which has diminished in palatability before the natural pastures have made sufficient growth.

In conjunction with these trials a manurial experiment has also been carried out during the last three years to determine the most profitable applications of simple and mixed manures to use on a winter fodder crop (Sunrise oats). The results show the advisability of an application of 1 cwt. of superphosphate per acre at planting, since this treatment has shown an average increase of 1 ton 10 cwt. per acre over the unmanured plots—a net profit of £1 3s. per acre, valuing the green fodder at £1 per ton and superphosphate at 7s. per cwt. This fertiliser has proved the most profitable.

To Combat the Banana Borer.

A consignment of the predaceous Histerid beetle (*Plaesius javanus*) was received during last year from Java and liberated in three different banana plantations on the Tweed River. In both the adult and grub stages of the beetle it is predaceous upon the borer. It is not yet possible to say whether the beetle has become established.—W. W. Froggatt, Government Entomologist.

Dairying under North Coast Conditions.

A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

To one accustomed to hearing of the boundless resources of the North Coast and of the abundance of feed it produces, it is perhaps a matter of surprise that the dairy-farmer in that part of the State could imagine anything better than his normal conditions, or should consider, even for the briefest space of time, means by which he could alter matters to his advantage.

Yet that is precisely what the dairy-farmer of that favoured district is beginning to do.

Impressed by the fact that with the increase of land values and of labour difficulties it is becoming essential that the farm shall be worked to the very best advantage, and that there are three or four—even five—months in the year when as a purely grazing proposition it does not return what it should. progressive men are beginning to cast about for means by which they can increase the carrying capacity of their farms.

Truth to tell, it is not on the farms of the progressive men that the difficulty is now so acute. Already many of them have learned that, great as is the productiveness of the Coast, there are limitations that have to be respected. and in one way and another they have solved—or are solving—the problem for themselves.

It is the farmer who is content with the methods of the past that needs to be awakened to the significance of the moment. The conditions of the industry are changing, and it is the man who is insensible to the facts who is likely to feel the pressure most keenly. It is becoming imperative to adopt those methods that will extract from every acre the maximum return—to regard the farm more than ever as a business proposition, the proper management of which demands forethought, acumen, and resourcefulness. Higher rents or interest charges and greater industrial difficulties make it essential that both the machinery and the methods should be the best.

In a measure the present limitations are linked up with the great fertility of the district. It is the very abundance of the growth in the summer that is creating the problem of the winter and spring. Tempted by the spectacle of the stock knee-deep in grass in the months of heat and heavy rainfall to graze as many cows as possible, the farmer encumbers himself with more than he can ever hope to feed properly in the colder and drier part of the year, when feed is invariably scarce and innutritious.

The difficulty may be said to be enhanced, too, by the manner in which this period of scarcity is viewed by many dairy-farmers. Instead of a stimulation to some means of overcoming the difficulty, it is regarded by them as an inevitable occurrence that must be borne with stoicism. The means by which the cattle might be maintained in condition and productiveness are within their easy reach, but the steps to that end must be taken when the cattle are literally wading in pastoral wealth, and who then would think

such abundance could give place to scarcity? Why, with the ground covered with grass, bother about winter and spring? It's months away, anyhow, and perhaps by that time something else will have turned up. And so the opportunity passes, and winter comes with its penalty of poor pastures, poor cattle, and poor returns—and, sad to add, poor farmer.

What has first to be recognised by these men is that the winter scarcity is not inevitable—that the resources of the district are ample for the emergency, and that means by which the difficulty can be surmounted are well within the reach of all.

Before turning to the discussion of these means it might be remarked that while primarily they involve the ensurance of feed—good in quality and sufficient in quantity—at the time when it is ordinarily deficient, there is also a need for improved animals. Good feeding can accomplish much, but cattle that can make use of the feed to the best advantage are not a whit less necessary to the solution of the problem. One cannot tour this district without a sense that there is probably no industry in Australia that is operating such a poor lot of machinery as dairying. Good cattle are to be seen, of course. Indeed, they abound, and every herd may be said to include a number—a good many herds have nothing else—but indifferently bred and ill-nurtured specimens, that impose upon their owners the labour of milking them twice daily for five or six months of the year with little or no profit, are also to be seen far too numerously, and one concomitant of a better feeding programme should be the disposal of all animal machines that cannot make the very best use of the feed supplied them. When the feed has been grown at the expense of time and labour this exclusion of every beast not directly profitable becomes even more essential.

Better feeding very soon involves better cattle, but whatever advantages may be gained by selection and culling, they cannot be maintained without a suitable and abundant food supply. Many men are up to date in every other respect, but are behindhand in feeding, and their returns are therefore little above the average. Seven or eight years ago the average yield of the herd of sixty-eight milkers at Wollongbar Experiment Farm was under 200 lb. butter per head. Last year the average of the herd of forty milkers was 401 lb. butter per head. Thus sixty-eight milkers gave a total of about 13,000 lb. butter, while forty whose feeding was specially studied yielded some 16,000 lb. In this noteworthy improvement selection no doubt helped, but improved feeding methods have had much to do with it.

The Limitations of Paspalum.

Paspalum years ago revolutionised dairying on the North Coast, but it has serious limitations. It produces enormous quantities of vegetation under the influence of summer heat and moisture, but towards the end of the summer it sets seed in abundance and deteriorates rapidly in feeding quality, losing all succulence and presently lodging quite flat. Throughout the winter it lies in an innutritious, tangled mass, on which the cattle steadily decline in condition and in milk flow.

But there is another limitation about paspalum. Its capacity for rapidly occupying country and choking out everything else where it is permitted to do so is well known, but it also has the habit after a few years of covering the ground with a mass of roots that on hillsides runs off a good deal of every rain, and everywhere excludes the air that so much contributes to the fertility of the soil and therefore to the value of a pasture. There are old paspalum pastures to be found that would not carry a beast to 5 acres, whatever they were capable of when they were young.

These limitations of paspalum have led many progressive farmers to attempt different methods of treating the grass, with a view on the one hand to improving the ration, especially during the winter, and on the other hand of renovating the pastures from time to time with a view to improving their feeding value.

Dealing with the latter aspect first, it may be remarked that of the various methods of renovating paspalum pastures that have been tried, the one most generally effective on this farm had been to plough up the sod, using a type of plough that will invert the furrow completely, covering the grass down and inducing quick decay, and then to plant a vigorous-growing crop that will crowd out the paspalum for the time being. For this purpose Saccaline has been found very satisfactory, the disc harrow being used to prepare a seed-bed after the plough. The method has the effect of increasing the humus content of the soil, and thereby its fertility and moisture-holding capacity. After a second cultivated crop the paspalum can be permitted to take possession again; the improved condition of such a paddock is invariably most pronounced and profitable.

While Saccaline is particularly useful for the first of these crops, other grasses, such as elephant, guinea, para, and kikuyu, are available, which provide plenty of sweet palatable fodder that is relished by stock. The renovation of the paspalum is thus made the opportunity for affording the cattle a change of feed. As the value of this method—capable of being combined so easily with the production of fodder crops—comes to be appreciated it may be anticipated that a goodly part of every farm on the Coast will some day come in turn under the plough. When it does, paspalum, instead of being regarded as a somewhat doubtful blessing, will perhaps be more highly and truly esteemed than ever.

If it be urged that the above is a draft upon the future, it is at least certain that scores of farmers are beginning to realise that it is not an inevitable necessity that their returns from the factory must decline to an almost negligible quantity for four or five months of the year.

Subdivision of Paddocks.

The first question that presents itself is whether—apart from growing crops—it is possible to manage the pastures to any better advantage, and the answer must at once be in the affirmative. The present system of one or two large paddocks does not permit of any part of the farm being rested from time to time, and of the encouragement of the best features of the pasture, and it perpetuates the pernicious system of a superabundance of feed

at one time and a shortage at another. Subdivided into several smaller paddocks, the cattle can be changed from one to another, and fresh green feed ensured at most times of the year. The white clover, the only plant that seems capable of existing in association with the paspalum, can be encouraged under such circumstances. The clover is the first plant to appear in the spring, but it has no chance of reaching the sunlight if the ground is covered with a thick mat of grass that lies where it died in the previous autumn. With several small paddocks it is possible to stock one or two heavily in the autumn and to keep the paspalum short, while in the others the mower could be used to cut the paspalum. The cut grass would have to be removed, or the clover would be no better off, but it could be stored either as hay or in the silo. Paspalum does not make very nutritious fodder in either of those forms, and would have to be fed in conjunction with some better material, but even for bedding the cut grass would be quite worth gathering. The farmer would not be likely to regret the increased work, however, for what with the overstocking of one part and the mowing of another, the paspalum pasture would be vastly improved the following year by the increased growth of clover.

A very important consideration in such a subdivision of the farm is the opportunity it affords for introducing variety into the feed of the cattle. The great value of variety, as has already been remarked, few farmers fully apprehend. Not alone does variety ensure a better balanced ration, but it leads to an animal using the maximum quantity of feed to maximum advantage. On a farm divided into small paddocks it would be possible, for instance, to devote one paddock to a mixture of English grasses, another perhaps to Rhodes grass, and another to smaller areas of grasses that could be used either for grazing or soiling.

A Variety of Pastures Required.

The English grasses that have done so well on the South Coast, lasting for many years, and with reasonable management maintaining their pasture value for long periods, are not suited by the atmospheric and soil conditions of the north. In the early days of settlement here they were planted after burns, just as is the paspalum to-day, but they never occupied the ground for long, and when paspalum was introduced farmers readily put cocksfoot, prairie, and couch aside. These grasses still have a real utility, however, yielding good growths of sweet, nutritious feed for two or three years, until the paspalum (carried in by cattle, birds, wind, &c.) has taken possession. In a farm subdivided as suggested above, the paddock of English grasses would provide winter feed of nice quality, and would be well worth its place in the scheme of things.

Rhodes grass might well occupy another of the paddocks. It was at one time somewhat extensively grown on the North Coast, and where it has been well handled it still resists the intrusion of the paspalum. Paddocks are to be seen that were sown twenty years ago and more, and that still provide excellent grass, with hardly a stool of paspalum to be seen. Rhodes requires to be kept well eaten down or it becomes so coarse that the cattle

will not eat it; but the very possibility of having such a useful change of feed on the farm should be a decided inducement to dairy-farmers to commence the subdivision of their paddocks.

The native blue couch has always been esteemed for its feeding quality, and for its capacity to withstand the spells of dry weather occasionally experienced. It has some capacity for resisting the spread of paspalum, and it is no uncommon sight, even to-day, to see the roadside tinted in spring and early summer with its delicate colour. Cases have been known of old cultivation land becoming occupied by blue couch after perennial rye. In one such case on Wollongbar Experiment Farm a 14-acre paddock yielded 1,200 lb. of blue couch seed—a very profitable crop.

Small areas of several other introduced grasses might be grown with advantage. Guinea grass has proved itself a fine fodder grass. It is erect in habit, yields up to 40 tons of green feed per acre, is sweet in flavour, and is readily eaten by stock. It could be grazed off, and should be kept low by being continually stocked, as it is apt to become coarse if it is allowed to become tall. It is propagated by root division, being planted in rows 3 feet apart, the sets 2 feet apart in the row.

Para grass is also useful in this way. It spreads quickly by long surface runners, which cover the ground and then send up stems that bear a heavy flag. Para grass makes good hay, but it will also stand an unlimited amount of trampling and grazing. It is propagated by stem planting in rows 3 feet apart, the sets being placed 2 feet 6 inches apart in the rows.

Kikuyu seems to be promising as a change crop, though it requires to be more fully tried out. In other parts of the State its growth has exceeded all expectations, and it is certainly worth watching. Like guinea grass, it should be kept short to prevent the growth becoming coarse.

Elephant grass, which is closely related to kikuyu, has recommendations, and handled properly provides a large amount of fodder of a somewhat coarse type.

Fodder Crops

So far we have dealt only with grazing, but the problem of better feeding of cattle on the North Coast is not going to be solved entirely in that way. Useful as some of these pastures would be on a farm laid out and worked as suggested, they do not fill all requirements. The occupation to maximum advantage of a farm on which paspalum provides an abundance of summer feed necessitates the production of crops that will provide succulent stuff in the winter and spring. Without these it is impossible to maintain the milk flow in the colder months, or to bring the cows into profit as the summer approaches with the assurance that they will start well.

The objection is often urged that "the land will not grow crops," and it must be admitted that it is not an agricultural district, but certainly it will grow fodder crops, and that without any great deal of work. Indeed, it is well not to attempt too large an area, for the soil will grow weeds as abundantly as anything else, and to keep a large area clean would involve more work than the average farmer can undertake. At the same time, a

reasonable proportion of every farm should be devoted to the growth of fodder crops. There are owners of good studs who hand-feed their cattle several months of the year. One was visited lately who supplements the paspalum for ten months in the year, and who sets apart nearly 25 per cent. of his total area annually for the production of fodder. No doubt there are those who consider this "over the odds," but it is no more than the nature of things in the district demands. The criterion by which we may arrive at the proportion of the farm to be devoted to these crops must be the large number of cattle carried and the poor quality and paucity of the winter pastures.

Taking a farm of 100 acres as a standard, a fodder area of 20 acres could be utilised as follows:—

Maize (half sown in October, half in December)	5 acres
Saccaline (sown in February)	5 „
Cow cane (sown in October)	5 „
Wheat (sown in April)	3 „
Sweet potatoes (sown in October and November)	2 „
	20 acres

Maize.—No crop could be mentioned that is more palatable to cattle than maize, and its fine vegetative habit and the variety of ways in which it can be utilised make it most valuable to farmers. The variety most suitable for green fodder in this district is Fitzroy. It should be drilled in at the rate of 18 to 20 lb. per acre, or even more, the object of the heavy sowing, of course, being to ensure fine stalks.

One of the recommendations about maize is the degree in which it lends itself to association with other plants that make a broader and more varied ration for stock. Pumpkins are most commonly used for the purpose, the seed being sown in the maize rows either at the same time or a little later than the maize. The latter method enables intercultivation to be carried on longer than if the seeds of maize and pumpkins are sown together. Good feed of a kind particularly suitable for grazing off with pigs in April and May is thus made available, or the farmer can harvest the pumpkins and the maize cobs before turning the stock in to make the best of the feed. The pumpkins can be fed out later as required, and the corn either marketed or fed as part of a more concentrated ration to the cows.

Italian rye grass also combines usefully with maize. About 2 bushels per acre of the grass seed may be broadcasted by hand when the maize is perhaps 3 or 4 feet high (about February), and the surface then lightly worked with a tine cultivator to cover the seed. The maize cobs are pulled in due course, and cows then turned in about June or July to graze off the maize stalks and the rye grass. As to subsequent treatment, the farmer has the alternative of breaking the ground up again in August preparatory to a summer crop, or he may nurse the rye grass for a while, grazing it at intervals; some farmers even get a profitable crop of grass seed before finally ploughing such a paddock again.

Cowpeas are another crop that lend themselves well to use with maize. They should be sown somewhat earlier, but they are most valuable for the degree in which they enrich the feed, to say nothing of their well-known value as a soil renovator when the plant residues and the animal droppings come to be ploughed under.

Saccaline.—The place of sorghum in the economy of fodder-growing on the Coast has been largely taken by the particular variety known as Saccaline. This sorghum originally attracted attention on this farm, and (aided by selection) it has proved of great value. It may be planted in August or September, and will then be ready for feeding off in February, at which time it is sometimes useful should the season be dry. Quite a good revenue can be obtained at this time, too, by harvesting the seed from a few acres. But the great utility of Saccaline is for winter feed. Planted in February, it will provide feed through the winter and until the end of August, retaining its succulence long after the maize has become dry and pithy, and yielding totals of 15 to 20 tons of greenstuff per acre. It may be sown either broadcast or in drills, but preferably broadcast, as it then runs to head better and yields more seed, while in the drill it seems to have a tendency to become coarser and woodier. The broadcast sowing should be a heavy one, as much as 30 to 40 lb. per acre being found quite satisfactory. It should be cut and fed to the cattle rather than grazed, and it is best of all when cut and fed with a concentrate such as cracked maize or crushed oats and bran. A good winter ration would consist of 30 lb. Saccaline chaff and 4 to 5 lb. of the concentrates.

More of the small cereals—*wheat and oats*—should certainly be grown in the district. They afford the farmer the option of feeding them as greenstuff in the winter, or harvesting them as hay in the spring and then chaffing for combination with concentrates like the grains mentioned above.

Of the wheats, Thew, Warren, and Huguenot have so far been preferred by the farmers who have grown these crops, while Algerian has had first place among oats. Farmers should, however, watch the performances of newer varieties, such as Clarendon and Cleveland wheats and of Sunrise, Ruakura, and even Fulghum oats. Of late the tendency has been distinctly in favour of oats, which have given some encouraging yields as compared with wheat.

Cereals are apt to be depreciated by smut and rust, more especially when grown on the flats, but if cut early it is still possible, even under such conditions, to turn the crops to profit.

The great value of these cereals is for the production of chaff with which grains, mill offals, &c., can be mixed. On rations so made up cattle do quite as well as on anything, maintaining condition and milk flow through the harshest spells. No doubt the weather usually experienced on the Coast makes it a difficult job to get hay of bright, clean quality, but with a little care it is usually possible to get a sufficient quantity of fair quality to justify chaffing, and the balance can be used in various ways.

The attractions offered by vetches and field peas in association with oats and wheat are great enough to justify their use far more frequently than is the case. They so improve the ration, whether fed green or as hay, that they are very desirable indeed.

Sugar cane and *Indian cane* have undoubted value for feeding purposes, and though for some years rather out of favour perhaps, have latterly been attracting more attention. They are an invaluable stand-by, and the spectacle is now becoming more common of a cow cane patch as part of the farm equipment. The great deterrent to the use of cow cane for some years was the practice of throwing it out to the cattle whole, but, chaffed and mixed with concentrates, it is useful, and hence is likely to be grown more extensively where the conditions do not allow more digestible and more easily handled material to be raised.

Several varieties of cane have been receiving attention in the last season or two, and there is plenty of evidence that soft, succulent canes are to be had that will not present the objections of the older, harder types. Indian cane has a usefulness of its own that should not be lost sight of. It should not be grown within the area in which the sugar canes do well, but outside that area, and providing it is chaffed and fed with concentrates, it should have a place in the fodder section of the farm.

The foregoing should sufficiently indicate the great variety of crops that are available for this important feature of the industry. No attempt has been made to discuss the cultural methods to be adopted with the crops, the present object being merely to bring them under farmers' notice.

If, as many are beginning to realise, hand-feeding in the winter and spring is becoming an imperative condition of successful dairying on the North Coast, there is certainly no need to question whether anything will grow. In truth, the farmer is embarrassed rather by the variety of the crops available and the strong recommendations several of them have for particular seasons and purposes. The most successful men of the district are already committed to the practice and are proving its commercial value, and it is for every farmer with a desire to do the best he can with his land to follow their lead before a sterner necessity presses him to it.

Practical Bacteriology on the Farm.

It happens occasionally that a dairy-farmer continually finds his cream graded as second-class. Sometimes he calls in the assistance of the Dairy Branch, and the visit of a Dairy Instructor often results in the source of the trouble being located without much difficulty. Sometimes the source of the trouble is not altogether easy to trace. In several cases recently the instructors have prepared on the spot plate cultures from likely sources of infection by harmful bacteria. These plates have been submitted by the Dairy Branch to the Biological Branch for detailed investigation, and the trouble has in this way been traced to its origin. The origin of the trouble being known, suitable remedies can be applied.—G. P. Darnell-Smith.

Pig-raising in New South Wales.

[Concluded from Vol. XXXIII, page 862.]

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Weaning and Ear-marking.

To wean the suckers (after eight weeks, for the latter half of which time they have been feeding themselves from a low trough as already mentioned), take them from the sow and put them in a securely-fenced yard, where a shelter shed and ample bedding have been provided. Turn the sow into them the next day for an hour or so, and again the following day. This is generally sufficient, though a very heavy milker may require to be turned in the third or possibly fourth time.

It is advisable to place an ear-mark on each pig of the litter weaned, for it is well to have a knowledge (apart from one's memory) of the parentage of the pigs, and to record their progress and other details. Special pliers are used for ear-marking. It is best to use as small a marker as possible; as the pig grows so does the ear-mark, and if the latter is in the first place unnecessarily big the effect is unsightly. The ear-marks given each litter of young pigs are then entered into a book, and at any future date the full details can be obtained about any pig on the farm.

The following specimen table shows how records can be entered for reference:—

Date of Service.	Ear-mark of Sow	Name of Sow.	Name of Boar.	When Due.	Farrowing Date	In Litter. Boars.	In Litter. Sows.	Died at Birth	Date when Weaned	Ear-mark given to Suckers.

Care of Young Pigs after Weaning.

Weaning time is a very critical period in the life of the pig. If the young pig has been given feed in addition to what it has received from the mother it should have made a good start and should then be fed, at least twice daily, all that it will eat up clean. The young pigs should have the run of good fresh pasture is possible, and should be fed on crushed grains, pollard, and skim milk, with lucerne, rape, or barley as green feeds, or pumpkins, mangolds, &c., if available. All slop feed should be fed while sweet, and should preferably be given warm, after having been steamed for about four hours.

The steaming of such grains as are given is attended by better results than merely soaking. The pigs should have a shallow wallow (preferably of concrete) in which the water is kept as fresh as possible. Wood ashes, cinders, and a piece of rock salt should be available in the yards, which should be provided also with a dry shelter shed and bedding. Too many pigs should not be kept in one yard. When about 3 to 3½ months old any boars that may have been kept should be separated and placed in different small paddocks, where they should be kept until ready for penning prior to marketing as porkers or baconers.

An important point is always to have the pigs graded, so as to keep the same sized animals together, thus preventing large pigs from jostling the smaller ones at the feed trough. Pigs will be found to do much better if a system of grading is in force. Approximately forty pigs can be run to the acre, but the exact number will depend upon the size of the animals and upon the pasture provided.

Castration.

Castration is an operation that must be attended to by both the stud breeder and the farmer who breeds for general market. Castrated boars will always sell the better, and as the process is a simple one it is strongly recommended.

The best time for the operation is when the suckers are 4 weeks old, while they have still another four weeks' suckling. The operation is then more easily carried out, and the suckers do not go back or stand still in their growth, as is the case when they are castrated later in their lives; they grow and do better, and the flavour of the flesh is much improved. The method of castrating is as follows:—

Wash the parts clean with pure water containing a little disinfectant and sterilise the sharp knife to be used. Hold the testicle between the first finger and thumb with the middle finger at the back to keep it from slipping, and make an incision in the scrotum just large enough to allow of the testicle's removal, keeping the cuts rather low to allow drainage and to prevent any matter coming from the pig entering the wounds and forming pockets. Then press each testicle through the cut made, cut through the thin tissue joining it, draw the cords well and scrape apart, rather than cut them off. Finally, apply around the cuts some antiseptic oil and see that they are kept clean, and free from flies, &c. If the operation is properly performed the pig should be well in a week or two. Mature boars (for the castration of which emasculators are generally used) usually take from six to seven weeks to recover and become fit for forwarding to market as backfatters.

Feeding.

The pig is well adapted for the disposal of many waste foods of the household, farm, orchard, and dairy, but unless these foods are in a sound and wholesome condition serious troubles may be caused by their use, and the quality and market value of the carcase may suffer. Of all farm animals the pig responds most readily to generous feeding; the stomach is only small, but the intestines are of great length, indicating great digestive powers, and for these reasons the pig must be fed frequently and at regular intervals.

The value of grazing and pasture crops is becoming more recognised, and when their use is combined with the feeding of maize, or other grains, good results are obtained. Green feed regulates and tones up the digestive and circulatory systems and keeps the animal in a healthy condition. It has to be recognised, however, that green feed will not entirely replace grain. Skim milk and butter milk are of great value as pig food, not only when fed by themselves, but more particularly when combined with maize, as they greatly increase the digestibility of the latter and effect a saving of grain. Favourable climatic conditions, plenty of good, clean water, good grazing land, and association with dairying on a small scale are factors in the cheap production of pork. Pigs should have access to rock salt, charcoal, or cinders, to make up for any possible deficiency in mineral matter in their ordinary rations.

Suitable Crops and Feeds.

Lucerne, either for grazing or for cutting and feeding in the sty, is the best green feed for the boar, sows, and young pigs. Wheat, oats, rye, and broadcast maize are also very suitable as green feeds for grazing; climbing varieties of cowpeas can be sown among the maize.

Sorghum should be fed only when matured. Rape is a fine winter crop, ranking next to lucerne for grazing purposes. Jerusalem artichokes are very drought-resistant, and grow well in light soils. The pigs should be turned in to harvest these after the plants have flowered.

Sweet potatoes, suitable for warm districts, are good for pigs when fed with a small percentage of maize or other grains, and skim milk; they are utilised in the same manner as artichokes for grazing.

Sugar beet and mangolds are excellent feed fed raw, and can be readily stored in a pit. Potatoes should be boiled and fed with skim milk or maize; the water in which the potatoes have been boiled should not be given to the pigs.

Pumpkins can be largely grown: they should be fed raw. Wheat and barley should be crushed and steamed for a few hours and fed with skim milk or whey.

With regard to mill refuse (pollard, bran, and sweepings), the market value of these determines whether it pays to feed on them or not, but a very little pollard mixed in milk keeps pigs growing and fattening well. Bran, which is properly rather a laxative than a pig food, is very useful for broad sows. Sweepings from mills, &c., should be used carefully, as they often contain a lot of rubbish. It is wise to soak the sweepings, so that any nails, nuts off bolts, or similar dangerous foreign objects may sink and be separated.

Skim milk, butter-milk, and whey are widely used as food for pigs. Skim milk, which should be fed with crushed grains or pollard, is a good flesh-producing food. It should not be used straight from the separator, but allowed to stand an hour or so, so that the gas may work out of it. When feeding butter-milk, always add pollard or crushed wheat, barley, or maize; otherwise the pigs will be soft and blubbery when dressed. Whey also should only be fed when mixed with crushed grains.

To avoid any chance of tuberculosis, all milk products should be boiled before being fed to pigs.

Following is a table of crops (mostly green feeds) to grow as food for pigs in the Hawkesbury district, and suitable for most other districts, always remembering that plantings must take place either before or after the frosts.

PLANTING Table of Crops Suitable for the Pig-raiser.

Crop.	When to sow.	When available.
Barley	February to April	May to October.
Rye	,, ,,	June to September.
Oats	,, ,,	June to November.
Rape	,, ,,	June to September.
Kale	,, ,,	August to October.
Cattle Cabbage	,, ,,	August to September.
Kohl rabi	,, ,,	August to September.
Cowpeas	September to October	January to April.
Pumpkins	,, ,,	January to June.
Maize	October to December	January to April.
Millet	,, ,,	December to April.
Sorghum	,, ,,	December to May.
Turnips	February to March	May to October.
Artichokes	March to April	July to September.
Sweet Potatoes	October	January to June.
Mangolds (autumn)	March to April	September to December.
,, (spring)	October to November	May to July.
Potatoes (spring)	August to September	January to February.
,, (autumn)	February	May to June.
Lucerne (autumn)	February, March, April	August to May.
,, (spring)	September to October	Following year.

ANTHRAX IN SHAVING BRUSHES.

FROM inquiries made by the Department in connection with a subject that has recently received considerable publicity, it would seem that the exercise of discrimination when purchasing shaving brushes constitutes some safeguard against risk of infection by anthrax, but that absolute elimination by the individual of all chance of infection is impracticable.

As to precautionary treatment of brushes, in a communication now received by the Department from the Department of Public Health, Dr. E. W. Ferguson, Principal Microbiologist, states that no certain means of disinfection appears to exist by which a shaving brush can be absolutely sterilised without damage to the brush. By immersion for half an hour in a solution of warm commercial formalin at the strength of one part in eight of water the bristles themselves can be sterilised, though there is no certainty that the formalin solution will penetrate the cementing substance in which the bases of the hairs are embedded, and it is possible that anthrax spores contained therein will escape sterilisation, and may later, with the weakening of the cement, make their way to the surface.

Both the British and American authorities, adds Dr. Ferguson, regard the sterilisation of the completed brush as impracticable, and require that the hairs be sterilised before manufacture into brushes. In regard to brushes manufactured in Eastern countries no reliance can be placed on the hairs having been effectively sterilised, even where a certificate of disinfection is attached.

Vitamines.

F. B. GUTHRIE.

In devising a ration, whether for men or animals, we have nowadays to take into account an additional factor hitherto unknown and about which little is understood at the present time, namely, the vitamine content. The literature on this subject is voluminous and for the most part so highly technical and specialised that it is difficult to extract matter that can be reproduced in a form suitable to the general reader. Furthermore, the experimental work has hitherto been carried out principally in substances used as food for human beings, and very little beyond generalisation is possible in the discussion of stock foods. The following few notes may serve to indicate the facts already established and the chief points to be considered

Interest was first aroused in the subject when a disease known as beri-beri was found to occur amongst people who subsisted on a diet of milled rice. Eijkman reproduced this disease in pigeons by feeding them on milled rice, and Fraser and Stanton were able to show that the disease (poly-neuritis). could be cured by feeding of rice-millings. Funk, in 1911, thought that he had isolated the active ingredient present in the rice-millings, and called it "vitamine." This was a specific for beri-beri, and was called anti-beri-beri or anti-neuritic vitamine.

The term vitamine is perhaps unfortunate and misleading. It was given by Funk, who thought that he had isolated a definite chemical compound having a composition analogous to that possessed by a group of organic substances known as amines, the prefix "vita" being added on account of their supposed importance to life.

The compound was not, however, isolated by Funk, and has not so far been prepared by anybody in a pure state. On this account, no doubt, many chemists are dubious as to the existence of any such body or bodies, and the misleading designation does not help to allay the doubts.

The nomenclature of the vitamines is rather confusing, as English and American authorities adopt somewhat different designations. There are at present three principal substances recognised as vitamines (though the number is generally regarded as being increased to five by the subdivision of the functions of two of them), to which the following names have been given :—

1. *Anti-beri-beri, Anti-neuritic, or Water-soluble B.*—This was the first vitamine to be recognised, as has been explained. It is found in all natural food-stuffs, that is, in raw foods. It is comparatively plentiful in seeds of plants, and in eggs, and it is also plentiful in cellular organs, such as liver and brain. In the case of cereals it is contained in the outer skin, which is removed in milling, and yeast and yeast-extracts are particularly rich in it. It is relatively low in flesh.

2. ***Anti-rachitic, or Fat-soluble A***—This vitamine is abundantly present in animal fats, such as cream, butter, beef-fat; in fish oils, as cod-liver and whale oil; in the yolk of eggs and in green-leaved vegetables, but not in roots.

3. ***Anti-scorbutic or Water-soluble C***—This vitamine is abundant in fresh vegetables, as cabbages; roots such as swedes and turnips; very abundant in lime, lemon and orange juice. It is found only in small quantities in animal tissues and is very easily destroyed by heating or drying.

These three are the principal recognised vitamines, but the existence of at least two others is suspected, and they must be taken into account. Thus, in the case of the Water-soluble B vitamine which is present abundantly in yeast, it is considered by more recent investigators that the vitamine which is an essential to the proper development of the yeast-cell, differs from the Water-soluble B, and they have proposed to designate it as Water-soluble vitamine D. It is also now considered not unlikely that the Water-soluble B may itself be composed of two vitamines—the anti-neuritic and the growth-producing vitamines. Similarly, the Fat-soluble A may possibly consist of two vitamines, the one having anti-rachitic and the other anti-ophthalmic properties.

The distribution of the three principal vitamines and the relative proportions in which they exist in various substances are given in the following tables:—

* TABLE A.—Showing Relative Proportions of all three Vitamines in Substances.

Vitamines appreciably present in—		Vitamines practically absent in—	
Fat-soluble A type (anti-rachitic)			
Cod-liver oil ...	+ + + +	Yeast ...	
Butter-fat ...	+ + +	Vegetable oils ...	
Cream ...	+ +	Seeds ...	+ ?
Egg-fat ...	+ +	Lard ...	+ ?
Green leaves ...	+	Nuts ...	-
Water-soluble B type (anti-neuritic).			
Yeast ...	+ + +	Cod-liver oil ...	–
Germ of seeds ...	+ + +	Vegetable oils ...	–
Rice millings ...	+ + +	Lard ...	–
Natural grains ...	+ +	Butter-fat ...	-
Nuts ...	+ +	Milled products, as rice, flour, &c. ...	-
Some vegetables ...	+ +	Cooked foods ...	+ ?
Orange juice ...	+ +		
Skimmed milk ...	+		
Water-soluble C type (anti-scorbutic).			
Lime and lemon juice ...	+ + +	Yeast ...	-
Orange juice ...	+ + +	Cod-liver oil ...	
Tomato ...	+ +	Nuts ...	–
Some fresh vegetables ...	+ +	Grain and seeds ...	-
Sprouted seeds ...	+ +	Canned foods ...	+ ?
Fresh unpasteurised milk ...	+	Cured meats ...	–
		Cooked foods ...	+ ?

* From "Vitamines," by A. D. Emmett.

* TABLE B.—Comparative Anti-scorbutic (Water-soluble C) Value of equivalent weights of Substances.

Fresh Lemon or Orange juice (raw)	100·0
,, Cabbage leaves or juice (raw)	100·0
,, ,, ,, (cooked 100°C. for 20 minutes)...	30·0
,, ,, ,, (cooked 70°-80°C. for 70 minutes)	10 0
,, Swede or turnip (raw)	60·0
,, Tomatoes (raw)	60·0
,, Green beans (raw)	30·0
Potatoes (cooked at 100°C. for 30 minutes)	7·5
Fresh Carrot juice (raw)	7·5
,, Beet-root juice (raw) . .	Less than 7·5
,, Beet juice (raw)	7·5
Dry beans, peas, &c. (raw)	7·5
Fresh cow's milk (raw)	1·0 to 1·5
Germinated beans, peas, &c. (raw)	3·0

*Quoted by Emmett, from Chick and Dalyell, Brit. Med. Journal, Vol. 2, 1920

* TABLE C.—Distribution of the three principal Vitamines among Cereals, Pulses, &c.

	Fat-soluble A.	Water-soluble B.	Anti-scorbutic.
Wheat, maize, rice (whole grain)	+	+	0
Wheat-germ	+ +	+ + +	0
Wheat and maize (bran) .. .	0	+ +	0
White wheaten flour, pure cornflour, polished rice, custard powder, egg substitutes... ..	0	0	0
Linseed, millet	+ +	+ +	0
Dried peas, lentils, &c. .	+	+ +	0
Pea-flour . .	0	0	0
Soja beans, haricot beans .	+	+ +	0
Germinated pulses and cereals ..	+	+ +	+ +

* From "Milling." 24th December, 1921, by F. W. O.

From these tables it will be seen that the references to specific stock foods are rather scanty. There are, however, a few general observations which may be made use of in devising rations for stock. Heating as a general rule appears to reduce slightly vitamine content. The water-soluble C vitamine is more stable towards heat than the fat-soluble. Milk, if properly pasteurised does not appear to lose its vitamines, but if not properly pasteurised and cooled quickly is almost devoid of this substance. Storing also tends to lower the vitamine content of foods. For these reasons (combined heating and storing) silage is less rich in these substances than the original material from which it is prepared. Similarly, bleached and burned hay is lower in vitamines than is hay that has been properly cured.

The fertility of the soil would appear to influence the vitamine content of the crops grown on it. Lucerne grown on rich land is generally rich in the vitamine A, but on poor soils both the lucerne and the milk and butter may be affected detrimentally in this respect. It is generally accepted that vitamines are not synthesized by animals which are dependent for them upon plants—that is to say, animal flesh and other products, such as milk or eggs or fats, are rich or poor in these bodies according to the richness or poverty of the animals' food in this respect.

The importance of milk as part of the ration, particularly for young stock and for animals suffering from disease due to diet-deficiency, has been studied by F. E. Place, of Roseworthy College, South Australia. He urges* that it is most profitable to keep young stock thriving, and that milk is an essential for them; that stoppage of growth may be rectified by the addition of milk to the diet, and that the stinting of milk in early life results in increased susceptibility to diet-deficiency diseases later on. Properly pasteurised milk is efficient. White-eye or opacity of the cornea in calves and young sheep is a symptom of vitamine deficiency, and disappears if milk is fed in the case of calves or fresh pasture in the case of sheep. In the case of diseases the dosage of milk may be large. Whole milk is rich in vitamine A, fairly rich in B, and contains C in variable quantities. Skimmed milk has lost some of its vitamine A.

It has already been mentioned that storing and heating are inimical to the vitamine content, and it may generally be said that fresh fodder, such as the grasses and particularly leafy vegetables (see tables on pages 54–5) are specially rich in the fat-soluble A type - more so than roots and tubers. Such foods are richest in this vitamine at an early stage of growth, as, for example, lucerne and carrots; bright green lucerne, properly cured, is a superior food, owing to its vitamine content, to light, bleached lucerne.

On germination, seeds have a higher content of both the anti-scorbutic and the anti-neuritic type. The nutritive value of eggs may be increased by feeding sprouted grain to poultry, especially in the winter.

The seasons and the climatic conditions also affect the vitamine content of fodder. In periods of drought the grasses are deficient in vitamines, a deficiency which is reflected in the milk.

If dairy-cattle are fed on stover without any grain, the milk produced will be deficient in these substances.

In the feeding of dairy-cattle the presence of vitamines in the ration is of great importance, much more so than in the case of beef-cattle. Milk, as stated above, is rich in vitamine A, fairly rich in B, and contains C in variable quantities. Meat (muscle), on the other hand, contains only small quantities of vitamine A, whilst the presence of B and C is somewhat doubtful. The vitamines present in the foods fed to cattle are stored only to a limited extent in the meat, but abundantly in the milk.†

Of the ordinary stock foods, the valuable oil cakes, coco-nut cake and cotton-seed cake have been investigated for their vitamine-content. They are fairly rich in B, contain A, but no C. The oils themselves, such as coco-nut oil, linseed oil, and cotton-seed oil, contain none. The only oils and fats containing vitamines in any quantity are such as are not fed to stock, such as cod-liver oil and butter (which are rich in Fat-soluble A) and whale-oil, some animal fats, orange-peel oil, and a few others, in which A is present, though not so abundantly. Similarly, sugar and starch contain no vitamines,

* A paper read before the Australian Association for the Advancement of Science, and published in the *Journal of Agriculture*, South Australia, May, 1921.

† "The Vitamines." H. C. Sherman and S. L. Smith.

so that the high feeding value of rations rich in fats or oils and carbohydrates is due soleiy to their calorific value. Lucerne is rich in vitamines A and B, fresh lucerne being as rich in this vitamine as in butter, and when fed to dairy-cattle increases the proportion of these vitamines in the butter produced.

Of seeds and grain used in stock and poultry feeding, maize (both yellow and white) is fairly rich in B, yellow maize containing in addition vitamine A.

Sprouted grains and malt are rich in C, fairly rich (?) in B, and contain A.

Whole wheat, oats and rye, like yellow maize, are fairly rich in B, and contain A.

Bran is fairly rich (?) in B, and contains A.

Millet seed is fairly rich in both A and B.

The choice of poultry foods is influenced by the fact that eggs are fairly rich in A, contain B, and (doubtfully) C. Egg-yolk is very rich in fat-soluble A

It will be seen that there still remains a large amount of research work to be done in the direction of stock-feeding with reference to the vitamine content of the various foods and their relation to growth. As experiments of this nature are intricate and laborious, necessitating the study of diseases induced in animals under close observation (albino rats, pigeons, chicks, and tadpoles are the victims most favoured), and the cure of these diseased conditions by proper feeding, some considerable time must elapse before the influence of vitamines in stock rations can be established satisfactorily.

Paper from Australian Timber.

It has been demonstrated for the first time in Australia, says the annual report of the Director of the Commonwealth Institute of Science and Industry, that good quality paper can be made from the wood of Australian trees. Experiments on a semi-commercial scale are being carried out to follow up laboratory results, to ascertain the paper-making qualities of pulps made from Australian materials, and to obtain data as to commercial possibilities.

A slip attached to the report states that the latter is printed on paper made by the Institute at Geelong through the courtesy of a local firm. The paper is stated to have been manufactured from pulp consisting of 60 per cent. "soda" pulp made from the Victorian timbers, mountain ash (*Eucalyptus regnans*), silvertop (*E. sieberiana*), and wollybutt (*E. delegatensis*), and of 40 per cent. imported "sulphite" pulp.

Feeding-off experiments at Coonamble Experiment Farm have demonstrated that continually stocked paddocks become rapidly depleted of their grasses, while the protected paddock is fairly well grassed.—J. N. Whittet, Agrostologist.

A Home-made Tobacco Wash for Combined Sprays.

A. A. RAMSAY, Principal Assistant Chemist.

In the following paragraphs is described the preparation of a home-made tobacco wash which can be used for all the purposes for which a nicotine concentrate such as that known as "Black Leaf 40" is applicable.

Home-made tobacco wash has hitherto been prepared by extracting tobacco waste (stems or dust) with boiling water, with or without the addition of washing soda or soap. This extract when used alone has given satisfactory results in the field, and it is generally agreed that the results obtained with it are quite equal to the results obtained from the use of a commercial concentrated tobacco extract when suitably diluted with water. When so prepared, however, the wash contains not only the nicotine in solution but also pectous bodies, gums, proteids, etc., which are present in the tobacco waste used. These latter make the infusion dark coloured, and trouble has invariably been experienced on attempting to use such tobacco infusions in combination with other sprays, such as lime-sulphur, by reason of the compounds referred to being precipitated as flocculencies which clog the nozzles of the spraying outfits. The presence of sodium compounds resulting from the soda or soap used appears to be a disadvantage rather than otherwise, since any compounds they may form are soluble ones.

Satisfactory results have now attended laboratory experiments designed to obtain a home-made tobacco infusion or extract that can be mixed with lime-sulphur without any change taking place in the combination. Briefly stated, the work done indicates that heating is unnecessary, and that the undesirable constituents present in the tobacco waste, which cause the trouble experienced on mixing sprays, can be readily precipitated by lime, and a clean liquid left which can be added to lime-sulphur without change.

In the trials carried out many methods of extraction and after-treatment (both at temperatures near boiling point and also in the cold) were made, but it is considered unnecessary to give these in detail. The experiments were first made in 1,000 cc., about ¼-gallon lots, and the method found to be most satisfactory was then tried on the largest scale convenient, namely, in a kerosene tin.

The quantities used were 2 lb. waste tobacco (dust), 3 gallons cold water, and 7 oz. quicklime. The quicklime was slaked with a small quantity of the water heated nearly to boiling point, and the mixture was added to the balance of the 3 gallons of water in the kerosene tin. The 2 lb. tobacco dust was then added, the whole well stirred, and the substances allowed to react for thirty-six hours, the mixture being well mixed from time to time. At the end of this time the product was strained through a piece of coarse sacking (chaff bag).

The following yields were obtained :—

Liquor which passed through ...	25·375 lb. =	2·5375 gallons =	84·6 per cent.
Liquor retained by tobacco dust	4·625 „ =	·4625 „ =	15·4 „
	30·000	3·000	100·0
Tobacco	2·000 lb.		

The residue retained on the chaff bagging was washed with water, and the washings added to the liquor which had originally passed through until the total volume of liquor and washings measured 3 gallons. This 3 gallons of liquor, which contained some of the yellowish precipitate, was transferred to a glass vessel so that observations might be made on the rate of settlement of the precipitate, and it was noted that good settlement resulted in two or three hours, leaving a clear light-coloured product, very much the colour of beer, which mixed readily with lime-sulphur.

This tobacco extract is twice as strong as that recommended by the Department for tobacco wash, and it will, therefore, require to be diluted with an equal volume of water for use. The materials used in its preparation can be purchased at present at the following rates :—

Tobacco stems, 6s. 6d. per cwt. in hundredweight lots, and at 5s. 6d. per cwt. to 4s. per cwt. in ½-ton to 5-ton lots.

Tobacco dust, 10s. per cwt. in hundredweight lots, and 8s. to 6s. 3d. per cwt. in ½-ton to 5 ton lots.

Lime, 8s. to 8s. 4d. per bag of 224 lb.

The cost of preparing 100 gallons of tobacco wash, as used for spraying, when hundredweight lots of tobacco stems at 6s. 6d. are purchased, is 2s. 3½d. per 100-gallon spray. When ½-ton quantities are purchased the cost is 1s. 11¾d. and, when 5-ton lots are purchased, 1s. 6d. The cost of the home-made tobacco spray will be about 2s. 3½d. per 100 gallons and may be reduced to 2s. or even 1s. 6d. by larger buying or by co-operative buying. This is only one-sixth to one-ninth of the cost of a spray of similar strength prepared from the commercial article.

ANOTHER TREBLE-PURPOSE SPRAY.

Home-made tobacco wash, prepared as described above, may be utilised in the make-up of a useful "treble-purpose" spray. A treble-purpose spray is the combination in one solution of remedial treatment for three classes of orchard pests. One such spray (described in this *Gazette*, July, 1922, p. 514) consisted of Bordeaux mixture, lead arsenate, and tobacco wash. Another such spray would comprise lead arsenate (for codlin moth, pear slug, &c.), home-made tobacco wash (for woolly and black aphis, &c), and home-made lime-sulphur (for scale insects such as San José and brown scale, and mites such as red and blister mites).

To ascertain what changes took place, and whether any harmful water-soluble arsenic compounds were formed, a spray was made up of lime-sulphur, at winter strength (1 in 10), home-made tobacco wash at the strength recommended by the Department (1 lb. waste tobacco per 3 gallons of water), and lead arsenate at the rate of 2 lb. per 50 gallons. Two brands of lead

arsenate (A and B) were tried, and controls were made by treating the same quantity of the lead arsenates alone, with the same amount of water as in the other experiments.

These mixtures were allowed to stand for seventy-two hours, and were repeatedly shaken at intervals. At the end of the seventy-two hours the preparations were filtered, and duplicate aliquots were taken from each for analysis, with the following results:—

—	Using lead arsenate A.		Using lead arsenate B	
	Found in solution per 1,000 cc treble purpose spray	In solution per 1,000 cc in water only	Found in solution per 1,000 cc. treble purpose spray.	In solution per 1,000 cc in water only.
	grams	grams.	grams.	grams
Arsenic expressed as arsenious acid	0121	0106	·0124	0109

It will be noted that while in the treble-purpose spray the amount of soluble arsenic compounds is slightly greater than in the aqueous solution. the difference is practically negligible, being only ·0015. It may be stated that if the figures given were increased to ·030, this would still be within the limits allowed by American regulations for water-soluble arsenic. No danger, therefore, need be feared from soluble arsenic compounds when using the treble-purpose spray described.

Discolouration in Honey from Lids of Containers.

It has often been noticed that honey round the edges of the lids of containers undergoes a change in colour, usually turning quite black. A lid showing the black fluid adhering to the edges was recently forwarded by Mr. W. A. Goodacre, Senior Apiary Inspector, to the Department's Chemist for examination, and the following report by Mr. A. A. Ramsay, Principal Assistant Chemist, should be of interest to bee-farmers:—

"The black colour of the honey submitted is due to tannate of iron, and has been produced by the interaction of tannic acid contained in the honey with iron from the container. When the lid of the container was examined it was noted that certain minute areas were not completely covered by tin and that the iron underneath was exposed, thus enabling the tannic acid present to form tannate of iron, which is black, and forms the basis of common ink.

"The lid submitted was wiped clean and covered with a strong solution of pure cane sugar containing a little tannic acid. On standing over night the syrup became black, similar to the sample of honey.

"To prevent the possible occurrence of tannate of iron (ink) care will require to be taken to see that the tinning on the containers used is satisfactory and that no iron is exposed to the action of the honey."

Insect Pests of the Cultivated Cotton Plant.

No. 2.—The Mexican Cotton Boll Weevil (*Anthonomus grandis*) and the Pink Boll Worm (*Gelechia gossypiella*).

WALTER W. FROGGATT, F.L.S., Government Entomologist.

In last month's article a group of small moths was dealt with, which is well represented in Australia, and which, under natural conditions, may be expected to infest the cotton fields of Australia. In the following paragraphs a brief account is given of two small insects that are the two great cotton pests of the world. Either or both of these pests could easily be accidentally introduced into Australia, either in cotton seed or in unginned or badly ginned cotton. It is therefore only by the total prohibition of all seed from the countries in which these insects exist and by the careful examination and treatment of all seed from elsewhere that we will be able to keep these pests out of the Commonwealth.

The Mexican Boll Weevil (*Anthonomus grandis*).

The genus *Anthonomus*, to which this beetle belongs, is a large one, for in Gemminger and Harold's "Catalogue of Coleoptera" (1869) a hundred species are listed. Of these, more than half are peculiar to the whole American continent; the remainder are chiefly found in Europe. One, described by Boisduval under the name of *Anthonomus australis*, ("Voyage d'Astrolobe," *Zoology*, 1835), is ascribed to New Holland. The Mexican Boll Weevil was described by a Bohemian in Schoenherr's "Catalogue of the *Curculonidæ*," published in Paris in 1843 (vol. vii, p. 232), and the habitat was given as Vera Cruz, Mexico.

This weevil was a well-known cotton pest in Monclovala, Mexico, as far back as 1856; from then on to 1862 it became such a serious burden on the cotton industry that cotton practically went out of cultivation in that district. It crossed the Rio Grande River at Matamoras, and appeared at Brownsville in Texas in 1892; two years later, it had spread northward over the whole of the cotton region of Southern Texas. In 1894, C. R. Tyler Townsend, as Temporary Field Agent, was sent to Texas by the United States Bureau of Entomology to investigate the cotton boll problem. This report will be found in *Insect Life*, 1895 (vol. vii, p. 295). In 1910, the United States Bureau of Entomology published a map, showing the spread of the cotton boll weevil from 1892 to 1910, when it had covered a large area of the cotton belt both north and eastward. In the early part of this year (1922) a departmental circular (No. 210) was issued by the United States Bureau of Entomology, accompanied by a similar map showing the spread of this beetle from 1910 to 1922. This clearly demonstrates that, in spite of all the knowledge and resources of the Federal Government behind them, the staffs of the Experiment Stations specially dealing with this pest have,

up to the present, been unable to check the advance of the cotton boll weevil. The estimated area of the great cotton belt of the United States comprises 705,000 square miles; of this area 600,771 square miles are infested by the weevil, leaving only about 105,000 square miles free from weevil at the end of 1921. It is stated in this report that, during the year 1921, 66,662 square miles of fresh territory were invaded by the boll weevil; so that it seems it will be only a matter of two more years, under normal conditions, before the whole of the cotton belt will be in the grip of this pest.

This little greyish-brown weevil varies in size, from one-eighth to one-third of an inch in length, including the slender snout, which is half the length of the body. It also varies much in colour. When the beetles first emerge, they are yellowish, then greyish-brown, and so on until the ground colour becomes almost black. The whole of the surface, except the rostrum or snout, is covered with fine greyish buff, slender, spiny or hair-like scales, which are thinnest upon the legs; it is these hairs that give the adult mature beetle the distinct greyish-buff colouration. It is a typical weevil beetle in that it has the snout long and slender and furnished with teeth-like jaws at the tip; the slender angled antennæ are clubbed at the tips, standing out on either side of the head. The basal portion of the head fits close into the thorax behind; and it has large rounded black eyes. The thorax is rounded on the sides and is slightly constricted at the junction with the abdomen. The body under the wing-covers is oval.

The last brood of weevils, at the end of the season, hibernate in the soil or among the remains of the dead cotton plants that are left in the field from the last harvest; they emerge the following season soon after the new crop of cotton plants appears above the ground, and they continue emerging for some time. In the early parts of the season they feed on the foliage, and particularly on the tips of the branchlets, but as soon as the squares start to develop the female lays her eggs in them. With her sharp-toothed snout she has no difficulty in cutting a hole into the square in which she deposits her eggs. The grub hatches within three days and, feeding upon the flower bud, causes it to wither and fall off. The grub remains in this flower bud and is full fed in from seven to twelve days; it pupates and remains as a pupa for from three to five days, and then emerges from the flower bud as a perfect beetle.

It will be seen that the full life cycle of this weevil ranges from two to three weeks, according to climatic conditions; taking the year through, it averages about forty-three days to complete the generation, so we can assume, allowing for the winter months, that there will be four or five distinct broods in the course of a year. As they are emerging and laying their eggs all through the season, and it has been ascertained that each female lays on an average 140 eggs in her lifetime, it can be well understood how rapidly they can increase and spread over a cotton field.

Further damage is caused by the male weevils feeding upon the squares and bolls, and thus causing them to drop without maturing. When the cotton plant ceases producing squares, the weevil attacks the bolls. With the first frosts, the adult weevils hibernate, and in looking for secure winter

quarters they migrate from field to field. Heat kills thousands that fall to the ground with the squares in the larval state, various parasites take a percentage, and the early frosts account for many more; but so prolific are these beetles that sufficient hibernate and emerge in the early summer to keep pace with the growth of the cotton crop.

In fighting the countless millions of these tiny weevils, clean cultivation appears to be the first essential; but under the conditions that cotton has been grown in the United States for the last twenty-five years, it seems that the landowner or the share-cultivator either cannot afford, or is unwilling to spend money or time in clean culture. Until new methods are adopted, such as burning-off and cleaning up after the cotton is harvested, there is very little hope of the cotton-growers of the Great Southern Belt reducing the ravages of this pest.

The Pink Bollworm (*Gelechia gossypiella*, Saund.).

This small moth was originally described by Saunders in the *Transactions of the Entomological Society of London* in 1842, under the name of *Depressaria gossypiella.* Under this name it is listed in Coles and Swinhoe's "Catalogue of the Moths of India" (1887). The locality given is Cawnpore; but a note is added: "Also recorded from Broach, where it has proved destructive to cotton." It is a well-known cotton pest in India, and according to Lefroy the insects are most abundant in October, when the cotton bolls are forming. He says that in Behar the larvæ live through the cold weather in the lint or seed of the cotton, emerging as moths in March or April. It ranges naturally over India, Ceylon, Burma, the Straits Settlements, Japan, and the Philippines. In Africa, besides Egypt it is found in British East Africa and in what was German East Africa.

The original home of the Pink Bollworm has been a matter of doubt among economic entomologists, but everything appears to prove that it was accidentally brought from India to Egypt in quite modern times. According to Willocks it was unknown in Egypt until 1903-10, and even in 1910 it was not a common insect. Two years later, however, it had spread through Lower Egypt, and in the following season (1913) it was recorded from all the cotton fields, doing an immense amount of damage. It was most active from July to October.

The nearest country to Australia where this moth is established is the Hawaiian Islands. Fullaway says it was introduced from India, and it was identified as this particular moth by Perkins in 1900. Says: "Highly injurious to cotton, Honolulu." In the "Fauna Hawaiiensis," section *Microlepidoptera,* Lord Walsingham gives a detailed account of this moth, and goes into the question of its range in India and elsewhere. Its food plants are the different species of cultivated cotton plants; it also feeds upon allied species of hibiscus and other malvaceous plants. In India it feeds upon bambia or okra (*Hibiscus esculentus*), on teel or hemp (*H. cannabinus*); and on hollyhock (*Althea rosea*), and also on cultivated cotton. In Hawaii it is found upon a malvaceous plant known as milo (*Thespesia populnea*).

The small greyish-brown moth is under half an inch across the outspread wings; the fore-wings are marked with darker blotches, and the hind-wings are fringed. It has no very distinctive characteristics as a moth. It lays its eggs on the underside of the leaves, as well as upon the bolls. The small yellowish caterpillar bores into the side of the closed boll, and as it increases in size becomes white, subsequently, however, when full grown, becoming pink or red. The caterpillar remains feeding in the boll for two or three weeks, by this time being about half an inch in length, and pink or reddish in colour. The caterpillars of the first brood then emerge. Gnawing a hole through the side of the bolls, they make their way down to the ground, and pupate under the shelter of any rubbish. Under ordinary conditions, they remain in the pupal state from ten days to a fortnight. The latter broods in September (says Willocks, speaking of Egypt) do not leave the bolls, but, remaining inside, spin their cocoons in the interior of the seeds or between two seeds webbed together. Most of them remain in the larval state in this manner from September till the following April; others carry on until November or December before they finally change into pupæ. Shortly after pupation the moths emerge. Thus a large number remain in the cotton seed, and this seed may be used for sowing the cotton fields.

This remarkable fact in its life history shows that these bollworms can remain quiescent, in the larval or caterpillar state, and also after they are fully fed, for over a year, and this fact renders them a difficult pest to control. It can also be readily understood how easily this pest can be distributed and introduced into any country in infested cotton seed. It is not a great distance from Honolulu to Sydney, and it is from this direction that we should in particular prohibit all cotton seed or unginned cotton.

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E. Dwight Saunders.—"Insect Pests of Farm, Garden, and Orchard" (1912), p. 261.

Lord Walsingham.—*Fauna Hawaiiensis (Microlepidoptera).*

Walter W. Froggatt.—"The Cotton-boll Wevil" (*Anthonomus grandis.*) *Agricultural Gazette* of New South Wales, Vol. xvi, Part 1., p. 23.

Success of Sunflower Silage.

"The cattle are going through the winter in fine style," ran a report from the Manager of Glen Innes Experiment Farm last June. "Production is being well maintained on maize and sunflower silage. The success of the latter, which gives larger yields in the field than maize, seems well assured. . . . Mammoth Russian gave nearly double the yield of maize."

Tree lucerne is a more delicate plant than kurrajong, and will not withstand dry conditions nearly as well. It will, nevertheless, grow on fairly poor country provided the rainfall is not too light.—J. N. Whittet, Agrostologist.

Poultry Notes.

January.

JAMES HADLINGTON, Poultry Expert.

Looking back over the year just closed one can but reflect that it has not been of the best for poultry farmers. The high cost of feeding during the last three months has not allowed the farmer the full benefit of the flush season of egg-production, particularly as the high cost of poultry foods has operated over the period during which the largest quantity of food is being fed—the rearing season. However, the position in both respects should now be easier. During last month a large number of cockerels will have been marketed, and from now on both cockerels and old hens will be disposed of as they become marketable. Thus the feed position will be eased by reason of the reduced number of birds to be fed. More plentiful and cheaper supplies of pollard and bran are also expected to become available from this month onwards.

It would be well for poultry farmers to realise that there is invariably a tendency towards scarcity, and consequently towards higher prices for these commodities in the period September to February in most years, and they should make their dispositions accordingly. It should also be realised that approximately 50 per cent. of the gross income from poultry has to be re-invested in poultry food. This means that the poultry farmer, to be successful, must possess at least some little business ability in order to be able to do himself justice in the purchase of foods and the sale of his products.

Fortunately the spirit of co-operation is abroad, and co-operative organisations are now springing up in poultry-farming centres, at least for the purchase of food supplies, while larger central concerns are handling poultry products for local consumption, cold storage, and export. These are developments that will enable poultry farmers generally to benefit largely from whatever talent is among them. Thus is poultry farming fast taking on features that were emphasised as necessary for the advancement of the industry by the writer in a paper read at the annual conference of poultry farmers in June, 1915, at Hawkesbury Agricultural College, from which the following is an extract:—

> Another weakness in the poultry industry, to my mind, is the lack of organisation. At the present time poultry keepers are scattered units without any cohesion whatever, either in the matter of buying or selling, or for the purpose of acquiring knowledge and instituting uniform methods into their business. The sooner we recognise our weakness in this respect the better for everyone engaged in the industry. I consider that we are a quarter of a century behind the dairying industry with its butter factories, creameries, and special organisations at all points. The time was, within my knowledge, when the dairying industry was in much the same position as the poultry industry to-day.

D

Winter time found butter 2s. and 2s. 6d. per pound, and summer time brought with it such prices as 6d. to 8d. per pound, and dairymen complained of the small amount of butter they were producing in winter, and the cheap prices they received when it became plentiful.

It may be well to remind ourselves at the beginning of another year that these are prime factors in the advancement of our industry, and that while a good deal has since been done much remains.

A Review.

It has been questioned in many quarters, and by individuals, does the price of eggs and poultry products generally keep pace with the cost of feeding?

In this connection it will be remembered that in these notes in August, 1919, a table was published setting out the cost of feeding, net average price of eggs, total value of production, and net return to the farmer over cost of feeding on a 12-dozen basis over a period of sixteen years. It is interesting to bring these figures up to date, and to consider them afresh. They are as follows:—

Year.	Cost of Feeding.	Average Net Price of Eggs	Total Value of Production.	Net Return per Hen over Cost of Feed.
	s. d.	s. d.	s. d.	s. d.
1903-4 ...	5 9¾	1 3¾	15 9	9 11¼
1904-5 ...	4 5½	1 0	12 0	7 6½
1905-6 ...	5 3½	0 11½	11 6	6 2½
1906-7 ...	5 10	1 0½	12 6	6 8
1907-8 ...	7 0	1 3½	14 6	7 6
1908-9 ...	7 9½	1 3¼	15 3	7 5½
1909-10 ...	6 9	1 5¼	17 8	10 6
1910-11 ...	6 5½	1 2	14 0	7 6½
1911-12 ...	6 1½	1 2½	14 6	8 4½
1912-13 ...	7 3½	1 3½	15 6	8 2½
1913-14 ...	5 9	1 2½	14 6	8 9
1914-15 ...	6 9½	1 2	14 0	7 2½
1915-16 ...	7 7	1 4½	16 6	8 11
1916-17 ...	6 10	1 3¾	15 9	8 11
1917-18 ...	7 8	1 4	16 0	8 4
1918-19 ...	7 10	1 5½	17 6	9 8
1919-20 ...	9 3	1 10	22 0	12 9
1920-21 ...	12 8	2 2	26 0	13 4
1921-22 ...	11 9	1 11	23 0	11 3

It is not contended that the prices received for eggs at all periods and in every instance exactly follow the cost of feeding, but taking periods of twelve months (and no shorter periods are of any use as a guide), it will be seen to what extent the prices received for eggs have followed upon or have been governed by the cost of feeding—and that notwithstanding all the incidences of buying, selling, cold storage, and export of eggs. It is somewhat remarkable that it should be so to the extent it is shown to be. The fact that it is so should be an encouragement to farmers who are now suffering somewhat from the high cost of feeding.

One thing, however, stands out clearly—that is, that it is quite useless, and only meeting trouble half way, to imagine that a set of temporary conditions with regard to cost of feeding for three or four months in the year will

wholly ruin the chances of payable returns being secured over the full twelve months. In other words, poultry farming must be calculated on the twelve months' basis. It is no use to question, "does poultry farming pay on the returns from this portion of the year," as is often done by amateurs during the early years of their experience. Hundreds of present day poultry farmers by their frugality and perseverance have built up good plants and have arrived at a stage where they are now employing labour from much smaller returns per hen than is shown to be obtainable at the present time.

Seasonal Troubles.

So far as the summer has gone there has been every indication in the prevailing conditions pointing to the likelihood of a hot summer. In years past one heat wave after another has been the cause of great mortality among poultry. In these visitations the novice poultry farmer has, of course, been the great sufferer, simply because he has not understood what they mean to his poultry, and is generally caught unawares, paying dearly for his experience by the loss of a large number of birds that might have been saved by taking proper precautions.

It should be understood that when the thermometer registers a shade temperature of over 102 it is time to look round the pens with a view to finding any hens that are being overcome by the heat and by the debilitating effect of drinking so much warm water, particularly on top of mash food. With the promise of an extraordinary hot day it is often advisable to feed a light feed of grain in place of the morning mash.

Experience in many of these heat waves leads me to the conclusion that the fermentation of the mash in the crop brings on such a condition that mature birds, and particularly old ones, very easily succumb to the heat. However, nothing but constant attention in looking round the yards, in the houses, and wherever the birds congregate, will prevent loss. The poultry farmer must be prepared to face the heat himself, and at the price of great vigilance to hunt out the affected birds. If caught in time before they are too far gone, dipping the birds in a bath of water, or holding them carefully with the head and neck free under water from a cool tap for a couple of minutes, and then placing them in the coolest shade about will save most of the cases. Usually the worst hours are between 1 o'clock and sundown.

Young stock under six months old, if kept under good conditions, rarely suffer from the effects of the heat in such a way as to cause many deaths. Still they should not be neglected in case they crowd into the houses in too large aggregations.

Value of Ladino Clover in Coastal Districts.

The outstanding feature of recent work in connection with clovers has been the success achieved with Ladino clover (*Trifolium repens* var.) in coastal districts. This is a strong-growing form of white Dutch clover, which spreads rapidly by means of long runner growths and also by seed.—J. N. Whittet, Agrostologist.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Wheat:—	
Bomen	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
Canberra...	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Hughes Bros., Greenacres, Pullabooka, *via* Grenfell.
	H. M. Hall and Sons, Studbrook, Cunningar.
	W. W. Watson, Woodbine, Tichborne.
Clarendon	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Coonamble.
Federation	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook. Cunningar.
	W. W. Watson. Woodbine, Tichborne.
Florence	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Glen Innes.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm. Temora.
Hamel	Manager, Experiment Farm, Temora.
Hard Federation . .	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	W. W. Watson, Woodbine, Tichborne.
Improved Steinwedel	W. W. Watson, Woodbine, Tichborne.
Marshall's No. 3 ..	Manager, Wagga Experiment Farm, Bomen.
Penny	W. W. Watson, Woodbine, Tichborne.
Sunset	Manager, Experiment Farm, Coonamble.
Thew	H. M. Hall and Sons, Studbrook, Cunningar.
Warden	Manager, Experiment Farm, Cowra.
	Manager, Wagga Experiment Farm, Bomen.
	W. W. Watson, Woodbine, Tichborne.
	H. M. Hall and Sons, Studbrook, Cunningar.
Yandilla King	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	H. M. Hall and Sons, Studbrook, Cunningar.
Oats:—	
Algerian	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Glen Innes.
Guyra	Manager, Experiment Farm, Glen Innes.
Lachlan	Manager, Experiment Farm, Cowra.
	W. W. Watson, Woodbine, Tichborne.
Mulga	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Cowra.
Sunrise	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	W. W. Watson, Woodbine, Tichborne.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

Storage Experiments with Lime intended for Sprays.

Results for the Completed Period of Trial.

A. A. RAMSAY, Principal Assistant Chemist.

A previous article on this subject, constituting a progress report of these experiments, appeared in the *Agricultural Gazette* last October, page 747. The experiments were continued for a further six months, aliquots from the two storage vessels being withdrawn at monthly intervals as before. In the following tables are shown the results for the first six months, together with those, month by month, for the completion of the period of the experiment.

Analysis at different periods of lime stored in a kerosene tin.

	November, 1921.	May (after 172 days).	June (after 203 days).	July (after 233 days).	August (after 264 days).	Sept. (after 295 days)	October (after 325 days).	November (after 356 days).
	per cent.	per cent.	per cent.	per cent	per cent.	per cent.	per cent.	per cent.
Calcium hydroxide	97·13	96·80	96 81	96·82	96·77	96·71	96·56	96·39
Calcium carbonate	·32	·66	·65	·64	·69	·75	·91	1·08
Other compounds	2·55	2·54	2·54	2·54	2·54	2·54	2 53	2·53

Analysis at different periods of lime stored in an earthenware jar.

	November, 1921.	May (after 172 days)	June (after 203 days).	July (after 233 days).	August (after 264 days)	Sept. (after 295 days).	October (after 325 days)	November (after 356 days).
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Calcium hydroxide	97·13	96·71	96 72	96·73	96·68	96·72	96 55	96·35
Calcium carbonate	·32	·75	·74	·73	·78	·74	·92	1·12
Other compounds..	2·55	2·54	2·64	2·54	2·54	2·54	2·53	2·53

From the figures given above it will be noted that during the first period (172 days) the increase in the amount of calcium carbonate was about ·4 per cent., and that during the second period (184 days) the increase in the amount of calcium carbonate was again about ·4 per cent. The increase over the whole period (356 days) is approximately ·8 per cent., and during that time the effective lime has been reduced by ·76 per cent., or approximately three-quarters of 1 per cent. Such a small increase is practically negligible, for it would mean a difference of less than half an ounce in a quantity of 4 lb. For example, in the 6-4-50 Bordeaux formula it would mean 4 03 lb. instead of 4·00 lb.—an inaccuracy which, however undesirable, is rarely to be avoided in field practice.

The kerosene tin used in the experiment remained bright, and showed no signs of rusting during the first period. At the end of the second period the

tin had become slightly rusted, more particularly at the portion level with the water. The colour of the lime, however, was pure white, and showed no trace of contamination from rust.

Loss of water by evaporation from the storage vessels varied according to the month of the year. Under laboratory conditions it amounted to ·0065 ounce per square inch of surface per day. For a kerosene tin this amounts approximately to 15 ounces per month under laboratory conditions.

The conclusions to be drawn from the above experiments are,—

1.—That lime may be stored under water even for periods of twelve months.

2. That there is a slight decrease in the effective lime, amounting to about ¾ per cent., but that this decrease is so slight as to be negligible.

An Object-lesson to Citrus Growers.

During our tour we had a good look through Californian citrus areas. The handling of the crops seems to work out very satisfactorily. Fully 90 per cent. of the growers are organised.

The community packing houses that are to be found throughout the Californian citrus areas are usually run on the contract principle, both the picking and the indoor work being done by gangs of men employed (as a rule on piece-work) by the owners of the houses. These houses are only a unit in the great scheme of organisation, for should their owners be left to dispose of their output unaided they would be in very little better circumstances than individual growers. Such are the marketing resources of the system of which they are a part, however, that their product is distributed to the best possible advantage, and gluts are avoided.

The principal organisation interested in the citrus output is the Californian Fruitgrowers' Exchange, which controls over 200 packing sheds, and, through a network of sales channels covering the whole of the United States, distributes from 70 to 75 per cent. of the citrus fruits grown in California, thereby regulating the course of the product until it reaches the hands of the retailer.

I have come to the conclusion that we could adopt many of the methods of Californian citrus growers with advantage. I would recommend that local growers (1) adopt a proper standard as to quality and size of fruit; (2) organise packing sheds, either individual or community; and (3) take action to prevent fruit being put on the market and distributed throughout the country in a dry state, to the detriment of the industry. There is no doubt that if New South Wales citrus growers intend shipping their product overseas they must have packing sheds; for the proper standardisation, grading, and packing of the fruit are three essentials if shipments are to be successful; and there is no doubt that in the course of the next two or three years, with tens of thousands of young trees coming into bearing, our production will far exceed the local demand, and that if we do not meanwhile develop outside markets we must go to the wall.—H. E. Peck.*

* These notes were compiled by Mr. Peck, a well-known orchardist of the Kurrajong, in connection with his recent visit to the United States.

January Work in the Apiary.

W. A. GOODACRE, Senior Apiary Instructor.

A GOOD deal has been said about the work to be carried out during progressive times, but not every apiarist is situated in a district where progressive conditions are obtaining. Where conditions for bees have been adverse for some time the chief aim of the bee-farmer should be to keep up the spirit of the hive, and in this matter the question of stores is very important. A colony with an ample supply of stores has undoubtedly a better chance of pulling through in good condition than a colony with supplies so light that it is apparently faced with starvation. When the food supply is so light that the bees are induced to economise and use less food than is necessary for their welfare a lowered vitality, and therefore less resistance to adverse conditions, will be the result. Moreover, where stores are light and there is nothing doing in the fields the bees rear less brood than where food supplies are ample, even though field conditions are the same. Methods of feeding syrup and pollen substitutes have been mentioned previously (see *Gazette* for last September, page 652). Where an absolute dearth of pollen exists rye meal can be given for a short period, but although there are a fair number of districts in which conditions are anything but progressive only in rare cases should any serious colony losses result this season.

Robbing by Bees.

When nectar is available in fair quantities from the fields the bees do not bother to look about for easier methods of obtaining supplies, and during progressive times the bee-farmer can extract honey and leave the honey-house door open without the bees bothering to come inside. It is different, however, when nectar is scarce, the bees making a raid on any honey left accessible to them. The practice of leaving honey available to the bees at such times is apt to excite them in such a degree that trouble is likely to occur, for when the supply of easily-gained honey is about cleaned up by the bees they will look around for more, and practically every hive in the apiary will be tried in the search for supplies. Consequently any small queenless stocks where little resistance is offered are often raided by the robbers, and even the more populous colonies may be overpowered. It is only on exceptional occasions that trouble is experienced in the case of populous or even medium-strength colonies where a queen is in the hive, but the excitement and the demands on the energies of the guards in protecting the hive have a serious effect on the vitality of the bees. Apart from this, it must be remembered that robbing is the chief means of the spread of brood disease.

When a weak colony is seriously overpowered by robbers it is advisable to remove practically all the stores, just leaving a small quantity of honey in one frame; when the robbers have removed this they will probably leave

and settle down. During the late afternoon, when the bees have finished work for the day, readjust the weak colony, see that it has brood and a queen, give the bees a frame of honey, and close them in for twenty-four hours. If it is a weak, queenless, stock it is best to unite the bees with a more populous hive.

Should a fairly populous hive become overpowered by robbers the placing of wet grass at the entrance and keeping the grass damp for a couple of hours will generally suffice to quieten matters down and allow the colony to offer resistance. Some apiarists prefer to have on hand a few robber cages made of wire cloth and taking the form of a small tent. These cages are placed over any colony that is attacked and seemingly overpowered. They are removed in the late afternoon. The colonies are then readjusted, brood being placed in the hive if the colony is queenless, and the entrance so reduced that only a few bees can pass out at a time.

It must always be remembered that prevention is better than cure. Do not induce the bees to rob by leaving honey accessible to them. Feeding honey in the open does more harm than good, and the results may be serious.

"An Indexed System of Veterinary Treatment."

Arranged in alphabetical order, with numerous cross references to direct the enquirer to the article where he will find the information he is in search of, this handsome volume of 636 pages, with its 195 excellently drawn figures, forms a handy resort for the student of veterinary methods, and the owner of diseased or sick stock about which help is sought. The author's confession that the scheme of the book had been before him for several years—from before the war, in fact—increases confidence that its arrangement, as well as its matter, is the result of mature consideration.

The author, Mr. W. Scott, F.R.C.V.S. (Fellow, also, of the Royal Society of Medicine), modestly hopes that to the student the work "may serve somewhat as a useful chart when he embarks upon the inexact sea of practical therapeutics, and to the practitioner as a 'refresher' in his routine work." Fully alive to the fact that nature is the master-physician, and that the practitioner is but her humble handmaiden, a rational line of treatment, based upon modern pathological and medicinal thought, supported by practical experience, has been kept prominently in view. The prescriptions given in the book and the lines of treatment suggested have stood the "acid test of exacting general practice, after much thought and prolonged experience."

In a short prefatory note, Sir Clifford Allbutt, Regius Professor of Physics at Cambridge University, commends "this very conveniently arranged system," and remarks that the author is equally at home in the clinical field and in the laboratory. Some prominent veterinary problems are touched upon—for instance, that of milk fever, which still remains obscure—so much so, that from a scientific and therapeutical point of view, insufflation (a successful cure) is as yet purely empirical.

The book bears its own evidence of the variety and completeness with which the interesting and delicate problems of animal diseases are approached.

Our copy from the publishers, Balliere, Tindall and Cox, Covent-garden, London.

Orchard Notes.

JANUARY.

W. J. ALLEN and S. A. HOGG.

The Picking and Handling of Fruit.

If the fruit is required for market purposes it should be slightly coloured, but still firm. It should be picked early in the morning when it is cool, and then be graded and packed. Where the haulage is for some distance there may be difficulty in carting during the cool hours, which in the summer time are between sunset and sunrise. If, on the other hand, this cool period is not availed of, the consignor will arrive at the point of despatch with his fruit warm, rendering it totally unfit to stand transportation for any distance. This is a point which is unfortunately very often overlooked, and one may often see carts loaded with fresh fruit on their way to the railway station in the blazing sun. Where it is found necessary to transport the fruit a considerable distance by rail, louvred cars should be secured ; the extra expense is justified if the consignment is sufficiently large, which could easily be ensured by growers co-operating and sending away a van or two of fruit at a time.

The fruit required for drying purposes should be allowed to remain on the tree until it has gained its maximum amount of sugar, but without becoming so ripe that it cannot be safely handled. It will often be found in the case of apricots, particularly in hot weather, that before the major portion of the fruit can be despatched as a fresh article to the market a lot of the fruit has become too ripe for that purpose. It should then be allowed to ripen further before being converted into the dried product.

Information on the methods of drying fruits appears in Farmers' Bulletin, No. 52, which may be obtained from the Government Printer, Sydney, price 10d., post free.

Fruit Pests.

Where apples are grown it will be advisable to spray the trees this month with arsenate of lead, and probably in February to follow with another application. In the coastal districts where there is greater liability to the attacks of fruit fly, care should be taken to examine all fruit subject to such attacks, and affected fruit should be immediately destroyed by either burning or boiling. On no account should the fruit be buried just for the purpose of getting it out of sight.

Cultivation.

In order to assist fruit-trees and vines in developing their fruit, thorough cultivation should be continued to conserve moisture, which is so badly needed at this time of the year.

Thinning of Grapes

In the case of varieties of grapes which produce very campact bunches it will be found an advantage to thin out some of the berries, especially if required for export or any distant market. In thinning the berries (just prior to packing) one is very liable to disfigure some of the remaining berries, or even puncture them, when using pointed scissors. It will be found that the best time for doing this thinning of the bunches is during the time they are developing, and when the berries have attained about the size of medium-sized peas. They may then be removed by cutting the stems of the later clusters and this can be readily done without damaging the remaining berries. This may seem somewhat laborious work, but it is absolutely essential if the grapes are to be exported and are of a very compact nature. It may be mentioned in this connection that a consignment of Ohanez grapes despatched to England last season arrived in a damaged condition, the weight of the bunches actually splitting many of the berries and thus encouraging mould. From reports received from the Agent-General in London and from the agents themselves, experience strongly favours a smaller case than that customarily used, and one that should not contain more than from 10 to 12 lb of fruit. Cases of the former size are known as "trays" on the London market. The following measurements are recommended —

Overall measurements	18 in x 1[illegible]¼ in x 5¾ in
Ends, one piece..	11⅝ in. x 5½ in x ⅜ in.
Sides, one piece ...	18 in. x 5¼ in. x ¼ in.
Top and bottom, two pieces each .	18 in x 5½ in x $\frac{3}{16}$ in.

Further particulars regarding packing may be obtained on application to the Under Secretary and Director, Department of Agriculture, Sydney, and from Farmers' Bulletin, No 130, "The Packing of Fruit," price 10d post free.

The Prospects of the Export Egg Trade.

It has been customary to doubt our ability to compete as egg producers with those countries with cheaper labour which had previously satisfied the English demand for eggs, but the factor that counts most in our favour and to which due weight has not been given is that our flush season of production is their period of low production. This. together with the cost of storage and the fact that eggs cannot be kept indefinitely in cold storage without deterioration, bring Australia into a more or less favourable position in this respect. The facts are that Australian eggs are competing favourably and returning to the producer an equivalent of the price ruling here in the cheap season when the eggs are shipped. Those best qualified to judge see promise of a very large trade in export eggs in shell. Export of eggs in pulp is not looked upon as attractive under our present conditions.—James Hadlington.

The number of farmers' grass plots has been increased during the year, the demand in the majority of cases being for winter grass mixtures. Seed for these plots has been obtained mainly from the seed reserves at Glen Innes and Bathurst experiment farms, as seed from these localities sets well and is of excellent quality.—J. N. Whittet, Agrostologist.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
St. Ives A. and H. Association	A. K. Bowden	Jan. 12, 12
Kiama Agricultural Society	G. A. Somerville	,, 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
Gosford A. Association	H. G. Parry	,, 26, 27
Wollongong A. H. and I. Association	W. J. Cochrane	Feb. 1, 2, 3
Inverell P. and A. Association	A. L. Varley	,, 6, 7, 8
Central Cumberland A. & H. Association (Castle Hill)	H. A. Best	,, 9, 10
Tahmoor and Couridjan	E. S. Key	,, 9, 10
Yanco A. Society (Leeton)	W. M. Evans	,, 13, 14
Shoalhaven A. and H. Association	H. Rauch	,, 14, 15
Tilba A. P. and H. Society	R. G. Swan	,, 14, 15
Dapto A. and H. Society	E. G. Coghlan	,, 16, 17
Campbelltown A. Society	J. T. Deane	,, 16, 17
Guyra P. A. and H. Association	P. N. Stevenson	,, 20, 21, 22
Pambula A. H. and P. Society	K. Longhurst	,, 21, 22
Milton A. and H. Association	R. F. Cork	,, 21, 22
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 22, 23, 24
Wyong District A. Association	G. L. Garnsey	,, 23, 24
Kangaroo Valley A. and H. Association	L. W. Vance	,, 23, 24
Hannamvale Branch Agricultural Bureau	W. H. Buttsworth	,, 23, 24
Newcastle A. H. and I. Association	E. J. Dann	,, 27 to Mar. 3
Southern New England P. and A. Association (Uralla)	C. T. Griffin	,, 27 to Mar. 1
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 28 ,, 1
Robertson A. and H. Society	E. S. Martin	,, 28 ,, 1
Alstonville Agricultural Society	W. J. Dunnet	,, 28 ,, 1
Moruya A. and P. Society	H. P. Jeffery	,, 28 ,, 1
Griffith A. Society	M. E. Sellin	,, 28 ,, 1
Braidwood P. A. and H. Association	R. L. Irwin	,, 28 ,, 1
Oberon A. H. and P. Association	C. S. Chudleigh	Mar. 1, 2
Luddenham A. and H. Society	L. W. Eaton	,, 2, 3
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	,, 6, 7, 8
Orange A. and P. Association	G. L. Williams	,, 6, 7, 8
Manning River A. and H. Association (Taree)	R. Plummer	,, 6, 7, 8
Yass P. and A. Association	E. A. Hickey	,, 7, 8
Tumut A. and P. Association	T. E. Wilkinson	,, 7, 8
Bangalow A. and I. Society	W. H. Reading	,, 7, 8
Hunter River A. and H. Assoc. (West Maitland)	J. S. Hoskins	,, 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	,, 8, 9, 10
Blacktown A. Society	J. McMurtrie	,, 9, 10
Rydal A. H. and P. Association	S. R. Prior	,, 10
Coramba P. A. and H. Association	H. R. Hindmarsh	,, 13, 14
Mudgee A. P. H. and I. Association	S. H. Somerville	,, 13, 14, 15
Cobargo A. P. and H. Society	T. Kennelly	,, 14, 15
Macleay A. H. and I. Association (Kempsey)	R. T. Tarrant	,, 14, 15, 16
Crookwell A. P. and H. Society	C. H. Levy	,, 15, 16
Cumnock P. A. and H. Association	K. J. Abernethy	,, 16
Camden A. H. and I. Society	G. V. Sidman	,, 16, 17
Batlow A. Society	C. S. Gregory	,, 20, 21
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	,, 21, 22
Gloucester A. H. and P. Society	F. S. Chester	,, 22, 23
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 26 to Ap. 4
Urbenville A. P. H. and I. Society	C. C. Wood	Apr. 4, 5
Auburn Branch Agricultural Bureau	J. M. Macey	,, 7
Richmond River A. H. and P. Society (Casino)	P. M. Swanson	,, 10, 11, 12
Moree P. and A. Society	C. G. Hobbes	,, 17, 18, 19

AGRICULTURAL SOCIETIES' SHOWS—*continued.*

1923.

Society.	Secretary.	Date.
Clarence P. and A. Society (Grafton)	... L. C. Lawson	... Apr. 18, 19, 20, 21
Ulmarra P. and A. Society	... R. N. Shaw	... ,, 25, 26
Maclean P. and A. Society	... R. D. Munro	... May 2, 3
Narrabri P. A. and H. Association	... E. J. Kimmorley...	,, 2, 3
Hawkesbury District Association (Windsor)	... H. S. Johnston ...	,, 3, 4, 5
Junee P. A. and I. Association	.. T. C. Humphrys.	. Aug. 21, 22
Holbrook P. A. and H. Society	... J. S. Stewart	... Sept. 18, 19
Narandera P. and A. Association	... W. H. Canton ...	,, 18, 19

A Case of Abnormality in Milk.

The following interesting case of abnormal milk is worth recording.—A sample of milk was received from Mr. H. Bignell, Upper Avon, Stratford, in the Upper Hunter Valley. Mr. Bignell writes: "The milk is from a virgin heifer (Jersey) about 12 months old; the heifer has had milk since about 5 months old, and has lately taken to another poddy calf about her own age and suckles her as if she were her mother." As the winter came in the heifer that was being sucked fell off in condition so much that she had to be removed to the home paddock and be hand-fed. It was estimated that if milked she would give about a pint of milk daily.

On examination this milk was found to have the following composition:—

	Per cent.		Per cent.
Total solids	... 12·74	Fat	2·65
Solids not fat	... 10·09	Ash	0·076

Milk which deviates from the natural secretion, the animal suffering from no disease, and milk secreted under unnatural conditions, may be conveniently classed as "abnormal." In "Foods: Their Composition and Analyses," A. Wynter Blyth records that instances of healthy cows giving milk differing essentially from ordinary milk are very few. One such, however, is recorded by Mr. Pattinson, who analysed the milk of a roan cow, which only gave 2 per cent. of albuminoids, and yielded no less than 4 grms. per litre of common salt. The animal is stated to have been in good health.

The following from New South Wales is recorded by Mr. M. A. O'Callaghan, in "Dairying in Australasia," page 445:—Milk from a heifer a year old, that had never given birth to a calf nor got in calf, gave the following analysis:—

Total solids	... 17·78	Fat	7·50

The sample was procured by Mr. Pedersen, Dairy Instructor, and the analysis was made by the Chemist's Branch.

Mr. J. A. Robertson, Herdmaster, states that the Department has on several occasions had maiden heifers come into milk, as a result of being sucked by other calves. The continual sucking excites the mammary gland, which becomes active. In New Zealand Mr. Robertson was shown an imported Jersey heifer which had never had a calf. The owner adopted the procedure of allowing calves to suckle her, which brought her into milk, and she has reared one or two calves, though so far she had proved barren.—F. B. Guthrie.

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Agricultural Gazette of New South Wales.

The Working of Fallows.

H. BARTLETT, Senior Agricultural Instructor.

IN the report of the wheat crop competitions of the western district, details were given of the workings of the areas which had produced the winning crops, and a study of these details shows that the better crops were produced on the most efficiently worked fallows.

These results must be gratifying to the farmers concerned, but there is undoubtedly room for still further improvement, particularly in regard to cultural methods and cropping systems Fallows should unquestionably be worked more frequently—particularly when the fallowing period is dry—and the increase in fungus diseases will undoubtedly soon compel the the introduction of broader cropping systems.

The object of this paper is not so much to advocate modern methods of farming, as rather to point to the probable cause of certain crop failures which came under notice while judging the crop competitions. During the usual tours of crop inspections, too, several crops came under review which showed disappointing results from the "partial" adoption of advanced farming methods, even to the extent of the rapid discing of stubble land, followed by the sowing of the seed. The case may be quoted of a Parkes farmer obtaining an 8-bag crop from a stubble paddock disc-cultivated in April and sown in May, while the adjoining "fallowed" paddock was practically a failure. Many crops on fallowed land in the Condobolin district during the month of September promised yields of five to six bags, but the results were disappointing, and actually they stripped only 9 to 10 bushels, while in the Forbes, Parkes, and Peak Hilll districts the opposite results were obtained, the return invariably exceeding expectations.

The reason for the disappointing returns quoted is more than likely the same in both cases—faulty seed-beds. It may be argued that the rainfall registered during the growing period at Condobolin was considerably lighter than at Farkes, but it must be borne in mind that the crop-growth was commensurate with the rainfall, and the lighter growth at Condobolin should have withstood the drier conditions. After a close study of the climatic conditions, the nature of soil, and the preparation of the seed-beds, it seems that the fallowing period holds the explanation for the disappointing returns, bringing to the fore a factor which has often been brought under farmers' notice, but the importance of which has not been sufficiently recognised—namely, the consolidation of the sub-surface soil; in other words, that section of soil between the loose dry mulch and the ploughing depth

The present seems an opportune time to place before farmers the importance of this consolidation, and the factors which assist in its production. Examination of the cropping area at Condobolin showed the soil to be loose and dry, and a hole was easily made with the toe to the ploughing depth—4½ inches. In the case quoted from Parkes the same applied to the fallowed area, while in the stubble-sown area, because of the shallow working only a shallow hole could be made. To understand the significance of these observations a few words upon the movement of soil moisture and the rooting system of the wheat plant are necessary.

The Movement of Soil Moisture.—Moisture which becomes available for the use of wheat plants is stored in the subsoil to a depth of several feet. It comes within reach of the roots by moving upwards under the influence of capillarity and surface tension. For such movement to take place the soil particles must be in a fine state of division and *packed closely together.*

Rooting System.—The roots of the wheat plant are of a fibrous nature, many penetrating to a depth of 4 feet, but the majority are to be found in the first foot of soil. The deeper roots will draw small supplies of moisture and plant food from the lower levels, but only in a subsidiary measure compared with the supplies drawn from the first foot of soil.

Burning off at Condobolin.

During the winter months frequent light showers kept the surface soil in a moist condition, thus promoting crop growth, but with the occurrence of hot and dry conditions during October the soil, which was in a loose condition, quickly dried out to the ploughing depth (4½ inches), thus throwing a mass of surface roots out of action. The sudden stoppage of such a large proportion of the moisture supply caused a wilting or drying off of the crop, resulting in the heads failing to fill.

In the case of the crop sown on stubble land in the Parkes district, where the loose dry mulch was of shallow depth, the moisture was able to rise from the subsoil by capillarity to within two inches of the surface, and only a slight lessening of the moisture supply occurred during October, enabling the crop to mature a full head of grain.

Consolidation.

Everyone is satisfied that fallowed land produces the best crops, and that early ploughing of fallows is advisable, but the questions of deep or shallow ploughing, the number of workings required, and the type of implements to use are all open to controversy, and all have a direct bearing upon the production of an ideal seed-bed.

The working of the land must vary according to the type of soil and proximity of subsoil; even the working of one type of soil from year to year must vary according to the season. The fact that fallowing conserves moisture and stores supplies of soluble plant foods for the needs of the succeeding crop is already well recognised, but the constant working of the fallow brings about another condition equally as important, though not so widely

understood, viz., the consolidation of the sub-surface soil. As previously stated, moisture which is stored in the subsoil will rise by capillarity, and for this movement to take place the soil particles must be finely divided and packed closely together, the upward movement of moisture being arrested when it comes into contact with a layer of loose dry soil.

The act of ploughing produces a comparatively deep layer of loose soil, and if it is exposed to frequent wetting and drying, and to the action of the sun and air while in the cloddy state, a sweetening effect takes place and its fertility is increased, and it is a wise policy on the part of the farmer to allow these actions full play for a certain period. It follows that the deeper the ploughing—within reason—the more will fertility be increased.

But the main consideration must be the production of a seed-bed having a nicely compacted sub-surface soil, covered by 2½ inches of loose dry soil. If the ploughing has been deep (say, 4½ inches) this consolidation can only be brought about by the action and weight of teams and implements, and by the percolation of water drawing the soil particles close together. Disregarding the cultivations which are necessary for the destruction of weeds, it is evident that a greater number of cultivations will be required to produce the desired consolidation if the fallowing period (July to April) be dry than if it be wet, as the packing effect of downward moving moisture is absent. As fallows should never be worked when dry, advantage must be taken of useful rainfalls during a dry summer to secure the desired number of workings. For this purpose a wider set of harrows may be more generally used than is at present the case.

With some of the loamy soils of the western district, where the subsoil is 12 to 18 inches below the surface and the rainfall is light, it is often a difficult matter to obtain the desired degree of consolidation if deep ploughing is practised, and it may therefore be more profitable to sacrifice the sweetening effect of deep ploughing for the advantages of a firm seed-bed. This also is often the case with the heavier, dark type of soils generally found in myall country, which are self-mulching.

Ploughing of Stubble Land.

Shallow ploughing of stubble land during March and April generally proves more profitable than deep ploughing owing to the greater consolidation, even though the soil may be exeessively "solid." As a matter of fact, the disc-cultivator is generally preferred for this class of farming in the western district as a more even seed-bed is produced. As this class of farming is fast disappearing, the above comment is really hardly necessary.

If a farmer is ploughing stubble land in January for cropping in May, and the season promises to be favourable, and if at least three cultivations are to be given prior to sowing deep ploughing is advisable; otherwise the ploughing should not exceed 3 inches.

By judiciously working the fallows, it is within the farmer's power to obtain the maximum sweetening effect of deep ploughing, to conserve the

maximum amount of moisture, and to produce the desired degree of consolidation of the sub-surface soil. Farmers are urged not to neglect the working of the fallows, but to get busy as soon as possible after useful rains throughout the summer and early autumn months.

Condoblin and Parkes Fallows.

In spite of all the labours of the farmer, if the fallowing period is dry the land cannot be given the desired number of workings; this was actually the case at Condobolin during the 1921–22 period.

A comparison of the rainfall records at Condobolin and Parkes during the fallowing and growing periods will bring to light the reason for the absence of consolidation in the fallows and the resultant wilting of the crops at Condobolin, and why the yields of the crops at Parkes grown upon well-worked fallowed land exceeded the early estimates.

RAINFALL.

Fallow Period			Growing Period		
—	Condobolin.	Parkes.	—	Condobolin	Parkes
1921–2.			1922.		
August	70	201	May	66	138
September	121	175	June	76	155
October	69	73	July	173	229
November	30	183	August	83	163
December	200	425	September	55	87
January	130	97	October	45	89
February	Nil.	124			
March	Nil.	10			
April	71	154			
Total	691	1,442	Total	498	861

During the fallowing period at Condobolin, the only rainfalls which permitted the working of the fallows were registered during the months of December and January, thus only allowing of two workings. This was wholly insufficient to produce the desired consolidation upon land ploughed to a depth of 4½ inches. Had it been possible to forecast the dry conditions, shallower ploughing of the fallows would probably have given better results. As deep ploughing and efficient workings had given satisfactory results in past years, the point is stressed that cultural operations must vary from year to year according to climatic conditions, even on the same type of soil.

At Parkes, during the same period, the incidence of the rainfall permitted the fallows to be worked during any of the months excepting March, and farmers were able to work the fallow four and five times. The greater rainfall also assisted consolidation, and allowed the subsoil moisture to rise almost to the surface and to feed the plants during the dry period of October.

Championship Field Wheat Competition in the Riverina.

[In 1922 the Royal Agricultural Society promoted Championship Field Wheat Competitions, and, with the approval of the Minister for Agriculture, Mr. H. C. Stening, Manager, Temora Experiment Farm, acted as judge. The following extracts from the report as to the Riverina competition, furnished to the President and Council of the Society by Mr. Stening, will be found of interest to all wheat-growers.]

EIGHT societies entered for championship honours, viz., Albury, Barellan, Berrigan, Ganmain, Henty, Lockhart, Narrandera, and Wagga. In the case of five of these societies, it was the initial effort at conducting crop competitions, which, coupled with the general interest and enthusiasm displayed, is an indication of the general stimulus that the championship has given to a healthy rivalry, not only between individual farmers in each district, but also between districts, the result of which must be an incentive to a general improvement in farming methods.

The tour for the purpose of judging was commenced at Barellan on 16th November and was completed in the Albury district on 22nd of the same month. With better organisation on the part of local societies, a saving in time of probably two days and a reduction of travelling could have been effected.

The season's rainfall throughout the Riverina has been of a very patchy character. According to the records of the Commonwealth Weather Bureau, the effective rains for the period April to October varied from 8·58 inches at Berrigan to 15·63 inches at Henty, the former representing 1·73 inches below the average and the latter 1·34 inches above the average for the period. The country in the vicinity of Henty and Wagga was the best favoured, while at Grong Grong just about the average rainfall was registered. In a general sense, the further west or north of this point the less propitious was the season; for instance, the rainfall was 1·73 inches below the average at Berrigan and 1·23 inches at Ardlethan, which is the nearest recording station to Barellan.

The distribution of the rain during the season was very irregular. At Wagga and the districts north of it the autumn rains were above the average, but in the more southern districts they were below the average, while the reverse was the case as regards the spring rains.

Details of the points awarded in the judging and of the cultural treatment of the crops entered are set out in the appended table. The rainfalls given in each case cover the period April to October.

The prizes were awarded as follows:—

J. Charles, "Stoneleigh," Grong Grong (Narrandera Society)	1
A. McDonald, "Bright View," Balldale (Albury Society)	2
E. R. Mudge, "Rowan Park," Berrigan (Berrigan Society)	3

The championship was won with an even crop of Federation, which was marred only by the presence of a little flag-smut and a sprinkling of wild mustard. Mr. Charles' success can be attributed mainly to intelligent and thorough cultivation, not only in the preparation for the winning crop, but as a definite practice over a period of years. It is plainly evident also that great care has been exercised in the production of a crop true to type.

The same remarks apply to Mr. McDonald's crop, which also scored well under the heading of "Freedom from disease," there being only a very slight infection of flag-smut. The late maturing varieties, Warden and Marshall's No. 3, required more moisture for their final development, and consequently there was evidence of pinched grain.

The Berrigan crop that gained third prize was grown on probably the lowest rainfall of all crops in the competition, but what stood in its favour was the excellent cultivation of the fallow. Had the whole of the crop been up to the standard of the major portion of it, it would have been close to winning the championship, but on a variation of soil of a heavier and richer type the crop was much lighter and affected with foot-rot.

The chances of success of some of the competitors were destroyed by reason of the use of impure seed. The loss of two points under "Trueness to type" just deprived Messrs. Paech's crop of a prize, while Mr. Koetz' crop of Yandilla King and Mr. Healy's crop of Turvey each suffered severe losses of points owing to admixture with another variety.

The preparation of the land for the crops grown by Messrs. Koetz and Healy was of the highest standard, and were it not for the use of impure seed these crops would have attained much higher distinction. It is worthy of note that these were not only high yielding crops, but together with Mr. Mudge's crop (another instance of good cultivation) scored highest points for "Freedom from weeds." In both cases the land was fallowed early and harrowed in early spring; then a month or two later a further cultivation was given with the spring-tooth cultivator. This cultivation is a decided advantage, not only in more efficiently guarding the escape of conserved moisture from the soil by means of the deeper mulch that is formed, but the sifting action of the spring-tooth cultivator prepares an ideal seed-bed, which, it must be borne in mind, is not the least important of the advantages of a system of fallowing. The finely divided sub-surface soil as left by the spring-tooth cultivator becomes compacted by rains prior to sowing, and in this condition the moisture-holding capacity of the soil and the capillarity of the soil are increased, and the soil is brought into the best possible condition for the ready germination of the seed and the vigorous growth of crops.

Some of the crops inspected had "hayed off" (or in other words had died off) while the straw was still green and prior to maturity; this was due to insufficient moisture being available for the final development, and in consequence the grain sample will be more or less "pinched," and the

Details of Awards.

Name and Address of Competitor.	Local Society.	Variety.	Methods of Cultivation.	When sown.	Quantity of Seed per acre.	Quantity of Superphosphate per acre.	Effective Rainfall.	Number of crops grown previously.	Apparent Yield.*	Trueness to Type Maximum 20.	Freedom from Disease Maximum 20.	Evenness Maximum 20.	Cleanliness.†	Condition and Appearance.‡	Total.
					lb.	lb.	inches.								
1. J. Charles, "Stoneleigh," Grong Grong.	Narrandera	Federation	Fallowed 4½ inches deep July-August, harrowed in spring, cultivated April, harrowed before and after sowing.	First week May	50	50	.	9th	30	19	18	19	28	28	142
2. A. McDonald, "Bright View." Balldale.	Albury	Warden, 30 acres; Marshall's No. 3, 20 acres.	Fallowed 5 inches deep August, harrowed October, disced April, springtoothed before sowing.	Second week May	56	56	9·33	12th	28	19	19	19	28	27	140
3. E. R. Mudge, "Rowan Park," Berrigan.	Berrigan	Federation.	Fallowed 4 inches deep July-August, harrowed September, disced October, harrowed November, harrowed before sowing.	First week May.	60	60	8·71	7th	27	19	18	18	29	27	138
4. B. E. and F. W. Paech, "Sunshine," Ryan.	Henty ..	Yandilla King	Fallowed 5 inches September, scarified January February.	Mid-May.	50	50	.	9th ..	27	18	18	19	28	27	137
5. A. A. Koetz, "Clarence Vale," Wagga	Wagga ..	Yandilla King	Fallowed 5 to 6 inches June-July, harrowed August, springtoothed September-October, springtoothed first week in March, harrowed after drilling	Mid-April	60	56		9th	28	15	18	19	29	27	136
6. A. Healy, "Templemore," Lockhart.	Lockhart	Turvey ..	Fallowed 5 inches first week in July, harrowed August, springtoothed September-January, and before sowing.	Third week May.	45	45		Over 6	28	15	16	19	30	27	135
7. A. F. Buerckner, "Valley Field," Methul.	Ganmain	Canberra	Fallowed 5 inches August, sown with combined springtooth cultivator and drill.	Early May.	60	45	12·91	Over 6	26	19	15	19	28	28	135
8. T. C. Davies, "Parkside," Brobenah.	Barellan	Federation	Fallowed 4 inches August, disced before sowing.	Early April	45	37		9th	23	13	15	18	25	26	120

* One point for each bushel of apparent yield. † First Crop, 24 points; second, 25; third, 26; fourth, 27; fifth, 28; sixth, 29; over six crops, 30.
‡ First crop, 24 points; second, 24½; third, 25; fourth, 25½; fifth, 26; sixth, 26½; seventh, 27; over seven crops, 28.

yields somewhat reduced. This has been experienced in previous years with a "dry finish," and in order to store up increased quantities of moisture in the soil, attention might be given to the advisability of extending the fallow period by making an initial cultivation of the soil during the summer, say as soon as the stubbles can be burnt in March. The soil is in that way put in a condition to absorb the autumn and early winter rains, and in consequence there is not only a larger quantity of moisture conserved in the soil, but the other benefits of fallowing are increased, such as the production of nitrates and the destruction of weed-seeds and fungus spores. It is the adoption of such a practice that has been largely responsible for the great increase in the average wheat yields during the recent years in the Wimmera districts of Victoria.

No less than three of the crops inspected were infected with bunt. For this a severe reduction of points was made, as the grain is depreciated for seed purposes and the disease is one which can be easily prevented with ordinary care. By the avoidance of seed known to be infected, by care in preventing infection, and by careful pickling of the seed, there should be no complaints on the score of bunted crops.

The control of flag-smut, however, is a much more difficult matter. This fungus disease, which was very prevalent and which is taking an increasing toll of wheat crops, not only reproduces itself by means of spores attached to the seed, but diseased stubble in the soil is a much more serious source of infection. As regards control measures, in addition to pickling, a good burn of the stubble of a diseased crop is most important. Furthermore, the spores in the soil should be starved by spelling the soil from wheat, using a rotation crop such as oats for one year and then a year of bare fallow. Some varieties, among them Federation and those of Federation parentage, such as Canberra and Hard Federation, appear to be very susceptible to this disease, and it would be advisable, where possible, to arrange for susceptible varieties to be sown on land on which the preceding crop was not infected.

Before concluding, I would suggest that, in arranging for future crop competitions, the heading "Condition and appearance" in the scale of points adopted should be eliminated, as the factors arranged for under this heading are covered by the other headings. In place of this heading, some societies allot points for methods of cultivation, but it is very questionable whether this heading should be substituted. Although it would serve in excluding the possibility of a "fluke" crop from winning distinction, it would, on the other hand, tend to defeat one of the chief objects of crop competitions, viz., the indication of the methods which are producing the best results, by assisting well cultivated crops by the allotment of points for methods of cultivation, in which, moreover, the judge must be largely guided by information supplied by the competitors, thus providing an opening for a dishonest competitor to make inaccurate statements. It seems better to eliminate the heading "Condition and appearance" without any substitution.

Farmers' Experiment Plots.

WINTER GREEN FODDER EXPERIMENTS, 1922.

South Coast.

R. N. MAKIN, Senior Agricultural Instructor.

EXPERIMENTS with varieties of wheat, oats, and barley were conducted on the South Coast during last winter on the farms of the following:—

C. T. Hindmarsh, Gerringong.
J. Chittick, Kangaroo Valley.
L. B. Garrad, Milton.
J. A. Martin, Pambula
J. R. Knapp, Bolong.
J. Timbs, Albion Park.

The object of the experiments was to ascertain the suitability of the varieties to South Coast conditions, and their capacity for yielding green fodder for dairy cattle. A great need is felt during July, August, September, and October for succulent green fodder when the pastures are rather scant and green fodder crops heading out during that time are invaluable in assisting to maintain the milk flow.

The Season and the Crops.

The crops were sown chiefly from the middle of March to the beginning of May—the earlier sowing being preferred.

The Bolong plots were sown with the wheat drill, otherwise the sowings were broadcast. The season was very dry during March, April, May, and June, but in July flood conditions were accountable for serious losses at Bolong, the amount of debris deposited on the wheat plots, together with the flooding, being too much for those plots, and also for the barley. Only the oats were harvested, and they were not up to their usual standard on this farm.

At Albion Park the heavy rain was also against the satisfactory growth of the wheat and barley plots. The total rainfall, covering the period of growth of the crops, was 2,123, 2,789, and 2,485 points at Pambula, Milton, and Gerringong, respectively.

Mild temperatures prevailed until July, and the usual westerly winds were not so prevalent during the spring months. Altogether the season was irregular. The crops were late in maturing—indeed, never have they been so late since the experiment plot system was established. The earliest were those at Gerringong, sown on 28th March.

Firbank wheat was harvested on 21st August, and was followed by the barleys and Sunrise oats in September, being in a frost-free situation. Under average conditions these crops should have been harvested in July. On the whole most of the plots on the different farms were harvested during October and November. When the crops ran up to ear the growth was remarkable, particularly with oats.

At Kangaroo Valley it was thought, at one time, that the crops would fail, but during September a most remarkable recovery was made, and Guyra oats made a record return for the South Coast experiment plots. This is the first occasion, after many trials, on which Guyra has done well as compared with Sunrise and Algerian. It has frequently rusted, although not badly, but it has attracted a good deal of attention from farmers, as it carries better flag and stools more than Sunrise. It is not, however, as early. Sunrise remains the earliest of the varieties so far tested, and is valuable chiefly on that account. Algerian is much the best as regards stooling capacity, and is consequently a heavy yielder under good weather conditions, but it will not come early, so that a farmer who depends on oats for green fodder should grow both of these varieties.

Ruakura did not do so well, and showed more rust than formerly. It will probably be excluded in favor of some of the new varieties that will soon be available.

Trabut barley again proved its earlier maturity as compared with the old Cape variety. The figures in the table do not altogether reflect the true yield as compared with the Cape variety, as Trabut is in most cases a fortnight earlier. Both plots were cut on the same day, and it was found in all cases that Trabut was past its prime. It is recommended for soils that will grow barley.

The best of the wheat plots were at Milton, where they were grown on a sandy hillside, the drier soil conditions being beneficial under such weather circumstances. The varieties tried have been under test for many years, and where it is required to grow wheat for green fodder all of them can be recommended with confidence.

YIELDS (per acre) of Wheat, Oats, and Barley Varieties for Green Fodder.

	Pambula.				Milton.				Kangaroo Valley.				Gerringong.				Bolong.				Albion Park.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c	q.	lb	t.	c.	q.	lb.	t.	c.	q.	lb.
Wheat—																								
Florence	9	19	1	4	11	6	2	12	8	8	3	10	7	1	0	16		......				....		
Firbank	8	13	2	8	13	10	3	25	5	10	1	2	6	11	3	0		......				....		
Bomen ..	10	5	2	24	15	6	3	24	5	18	1	16	12	12	2	0		......				....		
Greeley . ..	7	1	1	20		......				......				......				......				....		
Thew	6	7	3	12	15	10	0	2c	7	6	1	10	11	12	1	20		......				....		
Thew and field peas.	6	11	0	8		......				......				......				......				....		
Oats—																								
Ruakura	10	15	1	12	15	5	1	12	11	17	3	22	11	3	1	12	8	16	3	4	4	0	0	0
Guyra	10	17	2	20	13	17	3	12	20	1	2	12	8	17	1	24	8	7	0	16	3	17	2	12
Sunrise	11	1	3	4	16	11	3	4	13	4	2	16	13	4	0	8	10	7	3	2	3	16	1	4
Algerian	12	2	2	0	17	13	1	16	11	7	2	6	15	13	3	14	13	5	2	8	4	5	1	24
Barley—																								
Cape	6	0	3	24	13	10	3	24	10	8	3	24	8	14	3	12		......				....		
Trabut	7	17	2	0	10	18	3	24	11	0	2	4	12	7	1	0		......				....		

Upper North Coast District.

E. S. CLAYTON, Agricultural Instructor.

WINTER fodder trials were conducted last season in co-operation with the undermentioned farmers :—

E. Amps, "Goldsbrough," Camira Creek.
E. Green, The Risk, Kyogle.
R. W. Hindmarsh, "Wiaraga," Bellingen.
Mrs. F. Johnson, Condong, Tweed River.
G. Long, "Glengarry," Tatham.
M. McBaron, "Riverview," Raleigh.
C. Oliver, "Laurel Dale," Casino.
H. Short, "Warrawee," Dorrigo.

The weather throughout the whole season was very unsatisfactory, in fact, the winter was one of the worst experienced on the North Coast, particularly on the Richmond River. Sowing was delayed by the dry weather in the early portion of the year, and the unsuitable weather prevailing during the winter retarded the growth of the crops. The yields, therefore, in all instances are very gratifying, and clearly demonstrate to North Coast farmers the amount of fodder that can be produced in a particularly unsatisfactory winter.

The following table shows the effective rainfall at all the centres where records were kept :—

Month.	Kyogle.	Bellingen.	Condong.	Tatham.	Casino.	Dorrigo.	Camira Creek.
	Points.	Points.	Points.	Points.	Points.	Points.	Points.
April	......	155	......	.....	......	......	.. ...
May	271	525	144	73	351	....	......
June	349	311	212	231	222	515	......
July	281	708	771	284	150	482	320
August... ...	35	254	112	128	0	303	118
September ...	312	.....	47	594	253	1,500	960
October ...	......	.....	.. ...	......	......	205	174
Total ...	1,248	1,953	1,286	1,310	976	3,005	1,572

The rate of seeding for wheat, oats, and barley, was 2 bushels per acre. When the cereals were sown with field peas or vetches, 1½ bushels were used and the peas and vetches were sown at the rate of ½ bushel per acre.

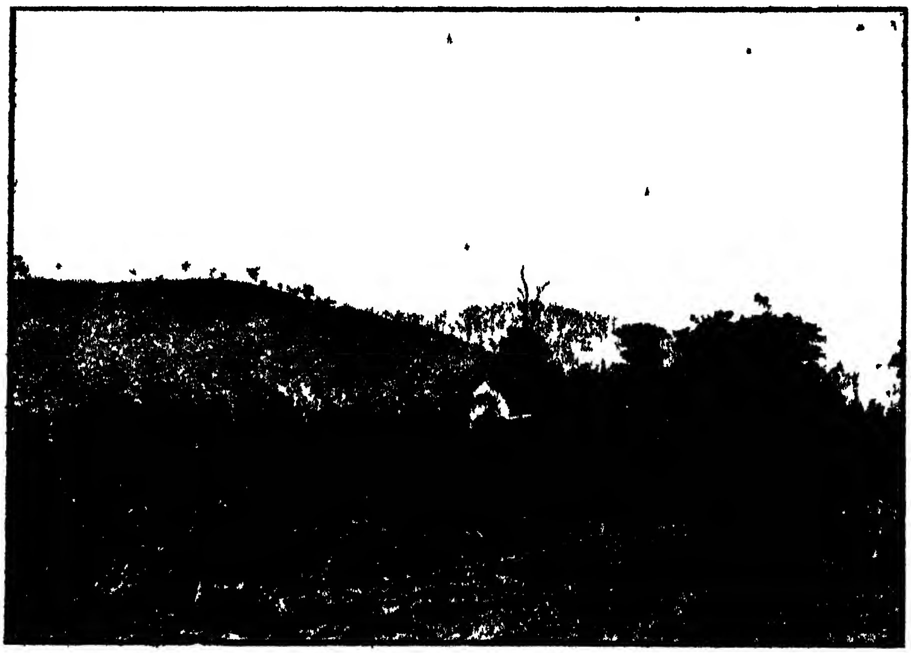
The Plots.

Camira Creek.—Poor sandy soil; previous crop, maize. The land was well prepared, but the sowing was very late on account of dry weather. The plots received 1 cwt. of superphosphate per acre. This is a district which shows wonderfully increased yields, as the result of the use of fertilisers; in fact, crops cannot be satisfactorily grown without the use of fertilisers. The best results were obtained from Sunrise oats. The Algerian oats would have

given better results had the crop been sown earlier; the hot dry spell which was experienced just as this variety was heading, considerably reduced the yield.

Kyogle.—Soil, alluvial loam. The land was well prepared, and the rainfall throughout the growing period was very satisfactory. The results from this plot were good; Warden wheat sown in combination with vetches gave the excellent yield of 17 tons to the acre. Black Winter rye gave a poor yield at this centre; field peas and vetches grew luxuriantly.

Bellingen.—Soil, alluvial loam, a little rough and dry at the time of sowing. Rust was noticeable at this centre, particularly on Hard Federation wheat and Mulga oats. The yields were very uniform, all varieties doing well, with the exception of Black Winter rye. The highest yield was produced by Thew and Grey field peas, but Warden and Grey field peas also yielded very well. Cape barley grew well, giving a yield of 9 tons to the acre.



Sunrise Oats on the Plots at Kyogle.

Condong.—Soil, alluvial loam; previous crop, maize, preceded by sugar cane. The plots were all harvested by the 11th September. Vetches did particularly well at this centre. The highest yield was given by Thew wheat and vetches.

Tatham.—Soil, alluvial loam of high fertility; previous crop, maize. The land was well prepared, but the weather was too dry to plant until 24th May. The germination and growth were excellent. Vetches and field peas

both grew well, and Mulga and Lachlan oats grew to a height of 6 feet 9 inches, while Sunrise grew to a height of 7 feet. The yields from this centre were heavy, and the crops caused a good deal of comment in the district.

Raleigh.—Soil, alluvial loam; previous crop, maize; ploughed once, disced and harrowed. The germination and growth were good. Sunrise oats and Grey field peas gave the highest yield, 11 tons to the acre. Trabut barley yielded at the rate of 7 tons to the acre, and although this was not as high as most of the other cereals, the crop was a most attractive one, and proved to be the most palatable to the dairy cattle.

A Green Fodder Crop at Mr. E. Green's farm, Kyogle.

Casino.—Soil, dark volcanic, rather heavy to work, and requiring very careful treatment to obtain the best results; previous crop, sorghum; ploughed once and worked into good condition. Germination good. Vetches proved a failure, but Grey field peas grew luxuriantly. The oats did very well, particularly Sunrise; this variety has consistently given excellent results in this locality, and dairy farmers here would be well advised always to grow a few acres for the winter.

Dorrigo.—Soils, a free working red volcanic loam. The germination was very fair, but the growth was rather slow. Black Winter rye gave a high yield, and two cuts were obtained; this cereal is palatable if cut before the ear emerges from the sheath, but if allowed to pass this stage it is unpalatable to stock.

YIELDS (per acre) of Cereals and Cereal and Legume Mixtures for Green Fodder.

	Camira Creek.	Kyogle.	Bellingen.	Condong.	Tatham.	Raleigh.	Casino.	Dorrigo.
Date of Sowing.. ..	12th July.	4th May.	29th March.	26th May.	24th May.	28th April.	19th May.	6th June.
	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t c. q.	t. c. q.	t. c. q.	t. c. q.
Sunrise oats	5 2 1	12 17 0	8 14 1	5 2 3	15 1 0	10 10 3	12 17 0	7 9 3
Algerian ,, ...	4 15 1	14 5 3	5 14 1	5 1 1	11 2 1	11 5 3	10 3 2	8 19 3
Guyra ,, ...	4 12 1	10 0 0	....	....	.. ..	....	....	9 7 2
Quandong ,, ...	4 ·5 2	....	...	....	14 0 1	5 3 0	....	7 13 0
Ruakura ,, ...	...	...	....	5 17 0	....	....	12 2 3	8 13 1
Lachlan ,, ...	..	...	..	5 7 0	15 3 2	....	...	....
Sunrise oats and Grey field peas	....	....	...	...	..	11 10 1	...	....
Sunrise oats and vetches ..	...	....	....	....	....	....	....	7 9 3
Mulga oats	...	11 8 2	6 14 1	...	15 16 3	....	...	7 13 0
Hard Federation wheat .	....	10 0 0	6 18 2	.	....	..	5 14 1	....
Firbank ,, .	3 11 3	14 5 3	9 6 1	5 0 0	10 5 1	10 12 1	8 4 1	5 14 1
Florence ,, ..	3 1 1	9 5 3	5 5 3	4 6 0	10 6 3	.. .	11 8 2	5 14 1
Thew ,, ..	...	7 17 0	8 5 3	....	8 16 2	10 5 3	8 16 3	5 2 3
Clarendon ,, ..	4 1 3	7 2 3	6 14 1	...	9 3 2	10 18 2	10 14 1	6 5 1
Canberra ,, .	3 14 0	9 7 3	7 14 1	6 0 0	....	.. .	6 10 1	...
Bomen ,, .	3 17 0	..	8 0 0	5 7 0	....	8 5 2	6 15 2	..
Warden ,, ..	..	5 0 0	7 8 2	4 12 3	14 0 1	11 1 1	....	5 14 1
Cleveland ,, ..	...	7 18 2	6 10 0	3 11 1	13 1 0	8 18 2	9 12 3	5 18 0
Zealand ,, ..	...	5 18 2	7 4 1	....	13 1 0	....	...	6 11 1
Thew wheat and Grey field peas	4 5 2	14 5 3	10 12 2	7 17 0	.	10 10 0	..	...
Thew wheat and Golden vetches	3 16 1	16 8 2	9 12 1	10 0 0	....	9 19 1	..	7 9 3
Warren wheat	...	...	8 18 2	....	..	10 14 2	.	....
Warden wheat and Grey field peas	..	...	10 2 3	...	15 3 1	....	....	...
Warden wheat and Golden vetches	...	17 0 3	...	....	....	..	....	..
Hard Federation wheat and Grey field peas . ..	....	15 0 0	....	...	.. .	....	....	. .
Gresley wheat	....	5 14 1	7 4 1	5 18 2	....	....	....	. ..
Cape barley	Failed.	12 18 1	9 2 0	....	7 2 1	....	...	....
Trabut ,, ...	....	....	...	....	....	7 1 0	....	....
Black Winter rye	....	5 14 1	....	...	....	....	...	.
Black Winter rye and Grey field peas	3 11 3	...	....	....	11 0 0	10 15 3	....	....
Black Winter rye and vetches	....	..	4 10 0	....	....	....	....	10 8 2
Vetches (Golden)	....	....	....	....	....	....	Failed.	....
Grey field peas	...	....	...	....	....	....	13 11 1	...
Thew wheat and Black vetches	...	....	....	..	...	10 5 2	....	...

YIELDS (per acre) in Winter Fodder Fertiliser Trials.

—	Camira Creek.			Condong.			Casino			Dorrigo.		
Crop	Sunrise oats.			Thew wheat			Thew wheat.			Algerian oats.		
Date of Sowing	12th July.			26th May.			22nd May.			6th June.		
	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.
*P7 Mixture, 126 lb. per acre	5	15	0	4	5	2	9	1	2	10	8	2
Superphosphate, 280 lb. per acre ...	6	2	2	5	17	0	13	8	2	9	7	2
,, 140 lb. ,, ...	5	2	1	5	1	0	9	12	3	9	2	0
*M7 Mixture, 182 lb. per acre	5	19	2	5	5	0	10	0	0	8	19	3
*M5 Mixture, 210 lb. ,, ...	5	16	2	6	8	2	11	1	1	9	7	2
No manure	2	18	1	5	0	0	8	16	1	8	19	3

*P7 Mixture, consists of equal parts of superphosphate and bonedust; M7, of ten parts superphosphate and three parts chloride of potash; M5, of two parts superphosphate and one part sulphate of ammonia.

Rate of Seeding Trial.

A trial to ascertain the most profitable amount of cereal to sow with field peas was conducted on Mr. Long's property. The result was as follows:—

	t.	c.	q.
Thew wheat 1 bushel, and Grey field peas ½ bushel per acre ...	16	0	0
„ 1½ „ „ „ ½ „ „ ..	12	13	1
„ 2 „ „ „ ½ „ „ ...	13	1	0

This experiment was conducted on rich alluvial land, and substantiates the results previously obtained on inferior land at Warrell Creek. These experiments certainly indicate that the smaller quantity of wheat (1 bushel per acre) sown with ½ bushel of field peas gives the highest yield, probably on account of the peas having more space to develop.

Comment.

The winter of 1922 was a very severe one for dairy farmers on the North Coast, and the absolute necessity of providing green fodder for the winter was again demonstrated. The early part of the season was so dry that the planting was delayed at most centres.

The combining of wheat with field peas or vetches has again given excellent results as to yield, and in addition the resultant fodder is much more valuable as a food for dairy cows. Field peas grown alone gave a splendid yield at Casino, but the addition of the cereal makes the crop easier to harvest. Vetches have given poor results on the poorer classes of soils, but are very suitable for the richer lands—at Kyogle, on rich land, a mixture of Warden wheat and vetches gave the excellent yield of 17 tons to the acre. Warden is a variety that is becoming prominent as a heavy yielder on the richer lands; at Tatham this variety yielded at the rate of 14 tons, and at Raleigh gave 11 tons to the acre. Oats have again shown their suitability for second-class soils.

The results of the application of fertilisers were very noticeable on the poorer classes of soils. At Camira Creek all fertilisers gave substantial increases over the no-manure plot, while, at Casino, an application of 2½ cwt. of superphosphate gave an increase of 5 tons to the acre. The mixture P 7, at 126 lb. per acre, gave the best results at Dorrigo, though at Condong the results were not so uniform.

Any thoughtful farmer who looks at the tabulated results of the variety trials will be impressed by the different behaviour of any variety under different conditions of soil and climate, and will realise how necessary it is for him to grow a variety that has given the best results in his locality, or under conditions as near his particular soil and climate as possible. Too many farmers just go to the local store and buy whatever variety the storekeeper happens to have, whether it is suitable or not. If suitable varieties cannot be obtained locally, farmers would find it more profitable to order their seed from some of the reliable seedsmen. Have the seed on hand, and the land well prepared beforehand, so that, if the weather is suitable, sowing can be carried out during April. This will provide fodder

during July and August, and a second sowing about the end of May will carry over into the spring, and enable the grower to make a certain amount of hay.

Last season was a particularly hard one for the dairy farmer—hundreds of cattle died of starvation throughout the whole of the upper North Coast. That this loss could have been prevented is demonstrated by the good yields of green fodder obtained in spite of the bad season. No dairy farmer should depend on natural pastures during the winter when green fodder is so easily and inexpensively produced.

Wheat Variety Trials at Cowra.

Trials with the object of ascertaining the most suitable varieties of wheat for hay and for grain for the district were continued at Cowra Experiment Farm in 1922, a number of new crossbreds and introduced varieties being included. As indicated in the appended table, early and late plantings were made in each section. Early planting took place on 11th and 12th April, and late planting on 28th May, in each case on land that had been thoroughly fallowed. Seeding was at the rate of 42 lb. per acre on the early-sown plots, and 52 lb. on the late-sown plots. For greater accuracy the plots were planted (with a 9-hoe drill) in duplicate, each plot being reduced at harvesting to an area of one-fourteenth of an acre.

The season was fairly favourable, except for a dry spell in June. Hot winds in November were responsible for premature ripening of the later maturing varieties, with consequent pinching of the grain and diminution in yields. The rainfall over the fallow period for the early planting was 1,215 points, and for the late planting 1,376 points The rainfall over the growing period for the early planting was 1,128 points, and for the late planting, 967 points.

The yields were as follows:—

Hay Trials.								Grain Trials					
Early Planting.				Late Planting.				Early Planting.			Late Planting.		
	t.	c.	q.		t	c.	q.		bus.	lb		bus.	lb.
Wandilla	3	15	1	Cowra No. 30	2	13	2	Wandilla	36	54	Waratah	34	3
Bathurst No. 17	3	10	1	Clarendon	2	11	2	Cowra No. 31	38	12	Newman's Early	33	51
Cowra No. 29.	3	8	2	Waratah	2	9	3	Cowra No. 29.	33	6	Canberra	33	30
Warden	3	7	1	Firbank ..	2	7	3	Onas ..	31	30	Cowra No. 28 ..	33	4
Cowra No. 30 .	2	14	0					Bathurst No 9	31	12	Cowra No. 29 ..	32	57
								Bathurst No 17	29	39	Cowra No. 31 ..	31	50
								Cowra No. 32.	29	15	Hard Federation	31	30
								Cowra No. 28..	28	21	Wilfred	29	20
								Hard Federation	28	0	Cowra No. 30 ..	28	42
											Cowra No. 32 ..	25	36

It will be noticed that several of the numbered varieties have done very well compared with the standard variety Hard Federation. Two of these (Cowra No. 28 and Cowra No. 29) were included in last year's trial and yielded heavily. None of the numbered varieties will be named or included amongst varieties recommended by the Department until they have undergone three years' trials.—L. G. Little, Experimentalist.

Varieties of Maize in New South Wales.

[Continued from page 33.]

H. WENHOLZ, B.Sc. (Agr.), Special Agricultural Instructor.

Early Morn.

THIS variety was introduced from America through the United States Department of Agriculture in 1918 as United States Selection 133, which name was abbreviated to U.S. 133, under which it was known until last year (1921), when it was deemed advisable to change the name to something less foreign, less liable to confusion on account of the number, and more expressive of some characteristic of the variety. It was accordingly altered to Early Morn, which is expressive to some extent of the extreme earliness of the variety.

It has given promise so far of succeeding not only in cold districts, but also as an early maturing variety in hot, dry districts, where it may be sown early and have a chance of maturing before hot, dry winds materially affect the crop. It is not yet widely distributed, but is certain to be largely grown in many districts with the above conditions when it becomes better known.

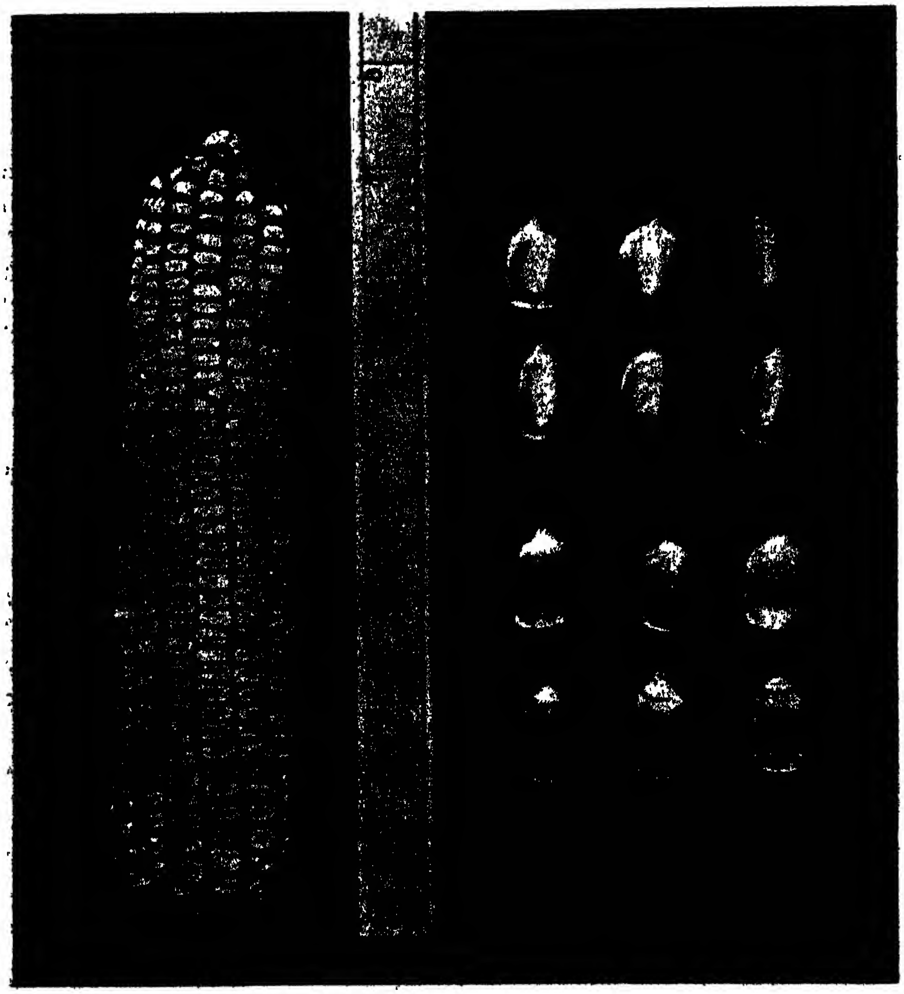
Early Morn maize is of very early maturity and only grows a very short stalk, usually about 4 or 5 feet. It has acquired the reputation in several districts where it has been grown of producing a cob on practically every stalk. The husks do not cover the cobs well, though this is not a great disadvantage in the districts for which this maize is apparently suitable.

The cobs are short (mostly about 7 inches long) of generally cylindrical shape and with twelve or fourteen rows of grain, with furrows of narrow or medium width between the rows. The grain has a very shallow, smooth dent, is short, thick, square, fairly hard, generally plump-looking, with a good bright colour (sometimes inclined to slight redness), and generally very attractive appearance. The grain has a tendency to roundness on the sides, and the core is of moderate thickness (not thin) for the size of the cob.

This variety is somewhat similar in appearance to Golden Glow, but it may be distinguished from that variety by its shorter, more cylindrical cobs, and its thicker, harder, shorter, squarer, and more rounded grain. It is also a week or so earlier in maturing.

Under quick-growing conditions this variety will mature in less than four months, but it takes longer in cold districts. The best results from Early Morn have so far been obtained in the coldest parts of the Northern Tableland, and also on the Central and Southern Tablelands, where maize-growing is thought to be hazardous on account of the very short season. It has also given promise for early sowing in dry districts where an early maturing variety is essential to largely escape the hot, dry winds of mid-summer. It is a hardy variety, and there are indications that it will succeed better on

poorer soils than other varieties of about the same maturity. Though favoured by some, it is not likely to be largely grown on the coast, on account of its low yields as compared with varieties which mature only three or four weeks later.



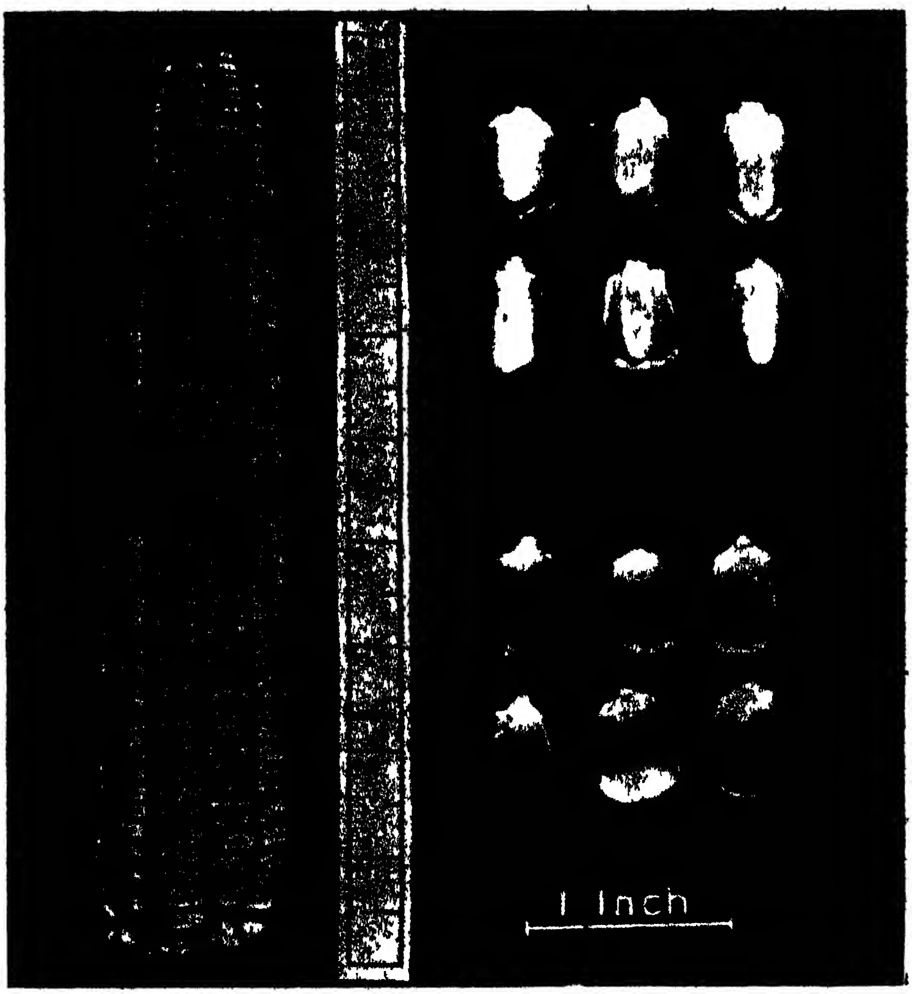
Early Leaming.

Manning Pride.

Manning Pride is a purely local variety of maize grown on the Manning River, particularly on the Upper Manning. Its origin is unknown, but it has characteristics so close to Golden Beauty that it is considered by the writer to be either a selected and well-fixed variation of this variety or the outcome of many years' selection of some cross with it. It is of about the same maturity as Golden Beauty, and grows a stalk of moderate height, with usually a single ear on the stalk.

The cob is of moderate length (about 9 or 10 inches—not usually as long as Golden Beauty), somewhat thin (like Golden Beauty), but generally

cylindrical throughout in shape, whereas Golden Beauty tapers somewhat towards the tip. It has ten or twelve very straight, uniform, regular rows of grain, with a medium-wide furrow separating them. The dent is medium-rough, therein differing from Golden Beauty, which is mostly smooth. The grain is fairly broad (about $\frac{7}{16}$ inch), fairly thin, and of good depth—about $\frac{3}{16}$ inch, and deeper than Golden Beauty. The colour is dark amber,



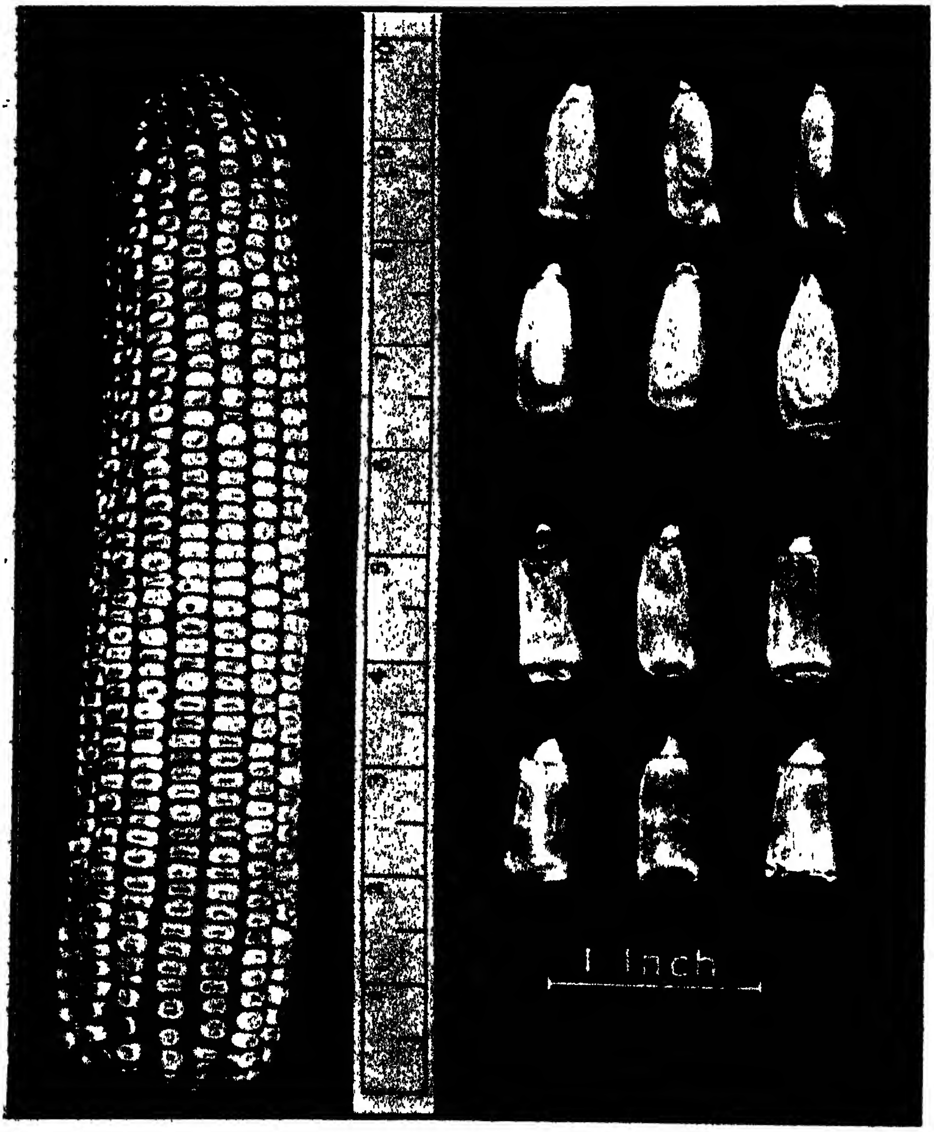
Manning Pride.

and this character also serves to distunquish it from Golden Beauty, which is golden or pale amber. The grain is of medium hardness. The core is fairly thin.

Manning Pride matures in about five and a half to five and three-quarters months (about the same as Golden Beauty). Tested for yield in comparison with that variety, it has generally been slightly inferior in yield, and is therefore not recommended at present for any district when Golden Beauty can be obtained.

Pride of Hawkesbury.

This variety first came under the observation of the Department of Agriculture at the Royal Agricultural Show in Sydney in 1918, when it was exhibited by some farmers from the Hawkesbury River district. At this and subsequent shows it attracted a considerable amount of attention on



Pride of Hawkesbury.

account of the large size of its cobs. In size of cob and depth of grain it stood out from other varieties shown, and on several occasions it has won the champion prize for the best ten ears of the Show. It is apparently not grown to any extent as yet outside the Hawkesbury River district, and

even there it is not widely grown, owing to the well-known yielding ability of other varieties, particularly Large Red Hogan, which is very largely grown in the locality mentioned.

Pride of Hawkesbury is a late-maturing variety, and grows a tall thick stalk and large cobs with thick shanks, which make it somewhat more difficult to harvest from the stalks than most other varieties. The husk covering is not usually too good, and in a wet season a fair amount of spoilt and mouldy grain is evident on the cob.

The cobs are 10 or more inches in length (sometimes a length of 13 inches or so is attained under very good conditions), of good weight and fairly thick. The dent is usually deep, but not usually very rough or pinched, and there are generally sixteen to eighteen or more rows of fairly regular grain, with a narrow to medium furrow between the rows.

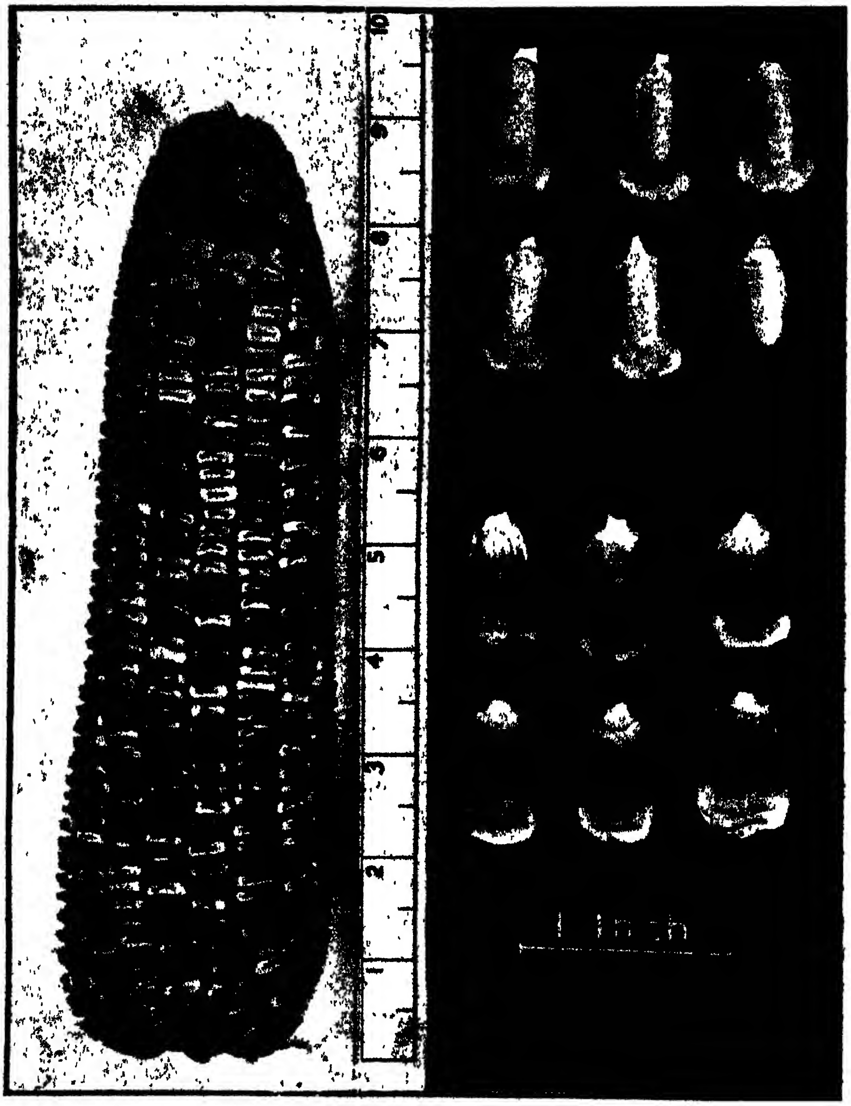
The grain is not generally uniform in this variety as to size, being particularly variable in breadth, but the most dominant type is not very broad; it may rather be described as somewhat narrow. The grain, however, is fairly thick and of great depth, often up to ⅝ inch. It is soft and starchy, and generally of a dull yellow appearance, owing to the large cap or soft starch extending fully down to the tip of the grain.

Pride of Hawkesbury takes about six and a half months to mature, and is grown only on the Hawkesbury River to any extent at present. There are indications, however, that it is likely to do well on other parts of the coast, especially on rich soil.

Ulmarra Whitecap.

A variety of maize which was at one time very widely distributed and very largely grown on the Clarence River was Whitecap Horsetooth. The origin of this variety is not clearly known. It seems, however, that it was the result of a fairly well-fixed cross between Yellow Horsetooth and some white variety. At any rate, the general appearance of the grain was a fairly dull yellow with a large white cap. The poor colour and the soft starchy character and poor feeding value of this grain caused it to be in considerable disfavour on the Sydney market, and Clarence River maize had consequently a bad reputation (especially in comparison with the Macleay River maize) in Sydney. Nevertheless, this variety was known to yield so well on the Clarence River that farmers were loth to give it up altogether. Many of them set about endeavouring to improve it in colour and feeding value, and to effect this began crossing it with a yellow variety of good colour and appearance, and selecting seed of a better type in these characteristics. Foremost among the farmers on the Clarence River who effected improvement in this maize was Mr. A. J. Miller, Ulmarra. He secured seed of a yellow variety of maize of good colour and appearance from a neighbour, and later still obtained some seed of Fitzroy (then known as Improved Yellow Dent) from Grafton Experiment Farm. The resultant crossbred maize has been called Ulmarra Whitecap. Though by no means fixed as to colour, and probably not likely to be in the near future (if ever, with

Mr. Miller's method of selection), it is a fairly true type of maize as regards other characteristics. In selecting his seed Mr. Miller has followed closely the lines advocated by the Department in its publications, though he is following his own ideas as to colour—not making any attempt whatever to eliminate impurity in this respect.



Ulmarra Whitecap.

Ulmarra Whitecap maize, therefore, presents the appearance in the cob of a very mixed colour, but in reality the mixture in colour is mostly confined to the cap of the grain, so that when the grain is shelled the impurity is not very observable (especially for market purposes). This maize is

undoubtedly superior in colour and feeding value to the Whitecap Horsetooth, and its superiority in yield to many other varieties was demonstrated in the Clarence River maize-growing contest in 1921, which Mr. Miller won with Ulmarra Whitecap by a clear 5 bushels per acre.

This maize grows a tall, coarse stalk, and is very late in maturing. The ears are generally fairly high on the stalk, and with a fairly thick shank make harvesting a little more difficult. The husk covers the ear fairly well, but it is not as good as the variety Fitzroy in regard to this character, which aids considerably in resisting weevil and weather damage to the grain.

The ears are of fair size, averaging 9 to 11 inches in length, fairly thick and of slightly tapering shape. There are usually sixteen or eighteen rows of grain, with medium to narrow furrows between the rows, and the grain has a rough to pinched dent. As mentioned before, the cob presents the appearance of much impurity in colour (mostly, however, only cap-deep). Owing to the apparent history of this variety, many cobs have white cores.

The grain is of medium thickness, about $\frac{3}{8}$ to $\frac{7}{16}$ inch broad, and of good depth (about $\frac{5}{8}$ inch), straight sided, yellow, with a fairly large pale-yellow or white cap, medium soft, and with a germ of small or moderate size. Generally speaking, the grain is very much like Fitzroy; a little larger, a little deeper, and a little rougher in the dent, but of not such good colour.

Ulmarra Whitecap takes fully six and a half months or more to mature, but can nevertheless be sown up till the end of December, or even sometimes in early January on the Clarence, which is very largely the practice, especially about Ulmarra, on this river. It has also yielded well on other parts of the coast, performing very creditably in the Manning River maize contest in 1920.

Despite its high yielding capabilities and also its good quality of blight-resistance (which it possesses in equal measure with Fitzroy), many farmers even on the Clarence River will not grow the variety on account of its mixed or impure appearance, preferring some purer variety of slightly less yielding capacity. Even though many farmers protest against this maize being called a variety, the fact remains that it and Whitecap Horsetooth are grown to a very large extent on the Clarence River, particularly about Southgate and Ulmarra, and no record of the varieties of maize grown in New South Wales would be complete without it.

(To be continued.)

Fallowing Finds Increased Support.

The Department's advice in relation to fallowing is being increasingly supported by the experience of the State's most progressive wheat-farmers, and the principle is generally being more extensively applied. During the year 1921-22, 1,416,000 acres were fallowed in New South Wales, or over 420,000 acres more than in any previous year.—A. H. E. McDonald, Chief Inspector of Agriculture.

Sugar-cane as Fodder.

A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

THERE has been marked increase in interest in sugar-cane as cattle fodder in the last year or two, and the crop promises to become once more a factor of some importance in dairying, withal, more intelligently and carefully used than in years gone by. There are many farmers on the North Coast who will remember how years ago it was largely fed to cattle, but they will also recall that it gradually fell into disfavour until many dairymen entirely neglected it. Any popular return to the crop is therefore distinctly instructive, being suggestive that either better varieties are being obtained or that better methods of using the material are being employed.

The fact is that both these factors are entering, and it may be expected that if sugar-cane again assumes a place of importance on the dairy-farm of the North Coast it will be because the errors into which most men fell in the past have been recognised. No doubt there are those who continue to adhere to the older methods, but they are likely gradually to become fewer in number as the advantages of better methods become apparent.

In the past the practice extensively adopted was to cut the cane when other feed was scarce, and to throw it whole into the paddock, where the cows could chew it over as they pleased to the ruin of their teeth if they were fed long enough on the stuff, and perhaps to the ultimate impairment of their digestive organs. While it was possible in this way to keep the animals alive, and even to maintain bodily condition, it was found that the effect upon a *low* milk-yield was negligible. Gradually, therefore, the use of sugar-cane as fodder ceased, and for a number of years the practice of feeding it to stock was largely neglected. A few farmers continued to use it as fodder, but as a matter of practice it had apparently had its day. However, the few who continued to grow cane and feed it found that there were circumstances under which it was of decided value, and they have steadily adhered to its use, until their ideas have gradually affected others.

Perhaps the point of greatest importance has been the recognition of how much better it is to chaff the cane than to throw it out to the cattle as whole canes. Chaffing makes it possible for the animals to manipulate the material easier and to waste less, and also enables concentrates to be fed at the same time and in a trough. In fact, the use of concentrates should be regarded as quite essential to feeding with sugar-cane, for in that way feed can be given that will maintain a good milk flow while the cane subserves the physical condition.

Sugar-canes have their undoubted utility in the frequent periods of drought that occur on the North Coast. It is always there, always more or less succulent, and even when only six months old—though then often deficient

in flavour, the sugar not having yet developed—cattle will eat it if other fodder is scarce. It may be presented as a fairly general rule that cane older than twelve months should not be fed to cattle, as after that it generally becomes too harsh and fibrous for easy mastication.

All canes have the limitation that it is a mistake to feed them exclusively. After all, sugar-cane is only a fat producer; in fact, young stock will fatten on it—but alone it is not a milk producer.

It hardly needs to be remarked that sugar-cane is excellent roughage for pigs, even the tops and strippings removed during the harvesting of the cane for the mill being also useful.

It has often been said that cattle cane is inseparable from dairying on the North Coast, and, if recent years have suggested that that was an overstatement of the facts, the present tendency is to find that the crop is not by any means negligible, but that, properly used, it has a valuable place among the North Coast fodders.

Fodder Varieties.

As stated above, one of the factors in the increased interest now being taken in sugar-cane is the use of varieties more suitable for the purpose, and the subject suggests itself as one to which farmers who are prepared to wait for a few years for their results could direct their interests with advantage. Unfortunately, sugar-cane seldom sets seed (or "arrows") under North Coast conditions, so that the opportunities for improvement by selection are somewhat limited, but there is, nevertheless, some scope for profitable work. Of existing varieties, two or three might be mentioned as of special interest in this direction.

Mahona, a variety at one time very popular for sugar purposes, but latterly attacked by fungus diseases, is a valuable cattle cane where sets can be obtained from disease-free crops. It should be used at twelve months old, or chaffed, or it is difficult for the cattle to manage.

Soutter's 90-Stalk Cow Cane is a recent introduction, but as a fodder cane it is distinctly promising. It has a pale-yellow stalk, very sweet and soft, and the cane is so slender that it can be used without chaffing if necessary, the cows being able to manipulate it in the stalks. So far, it is free from disease, and grows a good tonnage per acre. It can be cut at twelve months, though it may be left longer, and it ratoons strongly for a second and third cut.

Rufus Dia Dia was introduced to the district by Wollongbar Experiment Farm a good many years back, and throughout the interval since then a few farmers have continued to grow it, and to get good returns from it. It has gradually attracted attention, and there is now a larger demand for sets than can be satisfied. It is a strong-growing, purple-coloured cane, with plenty of leaf, sweet and soft, a remarkable stooler and ratooner, and a heavy yielder. The cane, which is all the better chaffed, runs about 1¼ inches in diameter.

Lily and Green is a variety that lately came under notice, and that seems to present some very attractive features. It is by no means a new variety, but a sample handled during last spring commended itself very strongly. It was very soft, very sweet, long-jointed, about 1¼ to 1½ inches in diameter, and a heavy yielder. Preferably it should be used at twelve months old, and it should be chaffed.

Indian Cow Cane is a cane of undoubted utility. It has been out of favour in recent years, but largely because it has not been properly handled. In the "cane belt"—that is, within the frost free areas where ordinary sugar varieties can be grown—it certainly is disappointing compared with other sorts, but planted where other varieties will not grow it is distinctly useful; and if the soil is good, and other conditions favourable, it attains a good height, and returns a good tonnage of soft cane. Where conditions are not favourable the skin is apt to be hard, and the fodder not too attractive.

In years gone by this variety was much misused. It was grown on all sorts of land and in all parts, and it was fed indiscriminately, with the result that cattle did not do well on it. Where they had nothing else they suffered severely.

The methods of growing cane for fodder closely resembles those described in connection with sugar-cane a couple of years ago in the *Gazette*, with the exception that the sets should be planted closer together to ensure finer stalks. Rows 4 feet apart, and the sets 2 ft. 6 in. to 3 feet apart in the rows, will generally give good results. "Plant deep, and cover lightly," is still one of the secrets of success.

The Possibility of Seasonal Forecasting.

In the *Rhodesia Agricultural Journal* for December, Mr. C. L. Robertson, B.Sc., A.M.I.C.E., discusses the possibility of forecasting the approximate nature of the coming rainfall season in the territory, and diffidently presents his expectations. Seasonal forecasts have already become a practice in one or two other countries, but this one presents some new features.

It is some indication of the immense scope of the factors that enter into such a forecast to say that connections have been observed between the Rhodesian rainfall and (*a*) the deviation from normal of mean flood height of Blue Nile at Khartoum during the previous August and September; (*b*) the deviation from normal of mean rainfall, India S.W. monsoon rains, during previous June to September; (*c*) the deviation from normal of mean rainfall, Rhodesia, four seasons previous; (*d*) deviation from normal of barometic pressure at Bulawayo during previous June to September; (*e*) deviation from normal of mean temperature at Bulawayo previous June and July; (*f*) deviation from normal of mean temperature at Bulawayo previous August and September.

As a result of an analysis of all this data, Mr. Robertson anticipates:—
"(*a*) It appears probable that the mean rainfall over the whole Territory will be slightly above normal this season. (*b*) The mean rainfall in the northern and western portions of Mashonaland appears likely to be somewhat under normal, and above normal in Southern Matabeleland and South-eastern Mashonaland."

Winter Grasses in the Penrith District.

J. N. WHITTET, Agrostologist.

THE plots sown on Mr. C. O. Holswich's property at Castlereagh, near Penrith, to demonstrate the value of winter grasses in this district have made exceptionally good growth during the period under review, namely, April to December inclusive. The areas, as a whole, are carrying a very considerable amount of good palatable green feed, while the surrounding natural pastures, which are mainly composed of couch grass, had browned-off during the period of frosts.

Hooker's Fescue, Tall Oat Grass, and Subterranean Clover.

Portion of Plot 1, at Castlereagh, showing a good mixture of grasses and clover

The plots were planted on 3rd June, 1921, with the following mixtures:—

No. 1.—Tall oat (***Avena elatior***), 5 lb.; Hooker's Fescue (***Schedonorus Hookerianus***), 8 lb.; Subterranean Clover (***Trifolium subterraneum***), 2 lb.

No. 2.—Cocksfoot (***Dactylis glomerata***), 14 lb.; Perennial Rye (***Lolium perenne***), 10 lb.; Prairie (***Bromus unioloides***), 4 lb.; Cowgrass clover (***Trifolium pratense*** var. ***perenne***), 4 lb.

No. 3.—Toowoomba Canary (***Phalaris bulbosa***), 5 lb.; Bokhara clover (***Melilotus alba***), 5 lb.

All seed, with the exception of Bokhara clover, germinated well; the stand on all plots is excellent. The grasses made rapid headway during the winter months, and in order of growth and frost resistance ranged as follows:—Toowoomba Canary, Tall Oat, Hooker's Fescue, Perennial Rye, Prairie and Cocksfoot. Cowgrass clover produced a large mass of feed early in the winter, making more growth than Subterranean clover. A herd of twenty milking cows was turned on to the plots at frequent intervals; the growth shown in the illustration is that resulting from the area being closed up for three weeks, prior to which time the cows had cropped the plants fairly close to the ground.

The animals showed preference for the grasses in the following order:—Tall Oat, Toowoomba Canary, Hooker's Fescue, Perennial Rye, Prairie, and Cocksfoot. Cowgrass clover was eaten before any of the grasses or other clovers, the Bokhara only being grazed when in the very young stage.

These plots are located on the river flats adjoining the lower Castlereagh-road. The soil is alluvial, and a large area of this class of country is growing couch grass, which is of little value during winter months.

The comparison between the winter grass plots and the surrounding country was very marked during the cold months of the year, and demonstrated the superiority of the mixtures sown over the growth present on the natural pasturage.

Wheat-growing for Profit.

It is doubtful if any branch of farming is so profitable in Australia as wheat-growing. It is rare for a wheat-farmer to fail, while in numberless cases men who started with little more than sufficient to pay a very modest deposit on their land, are now in affluent circumstances. This is principally due to the climatic and soil conditions rendering it possible for extensive areas to be cropped at a very low cost, but it is also due to the fact that the demand for wheat is practically unlimited, and the system of marketing enables the grower to get the best returns for his produce. The wheat-farmer is also able to diversify his farming by raising sheep, and here again his market is practically unlimited

The stress of competition in the professions and trades is becoming very keen, but there is profitable occupation awaiting those who have moderate capital, in the growing of wheat to feed the hungry nations of Europe and in the raising of wool to clothe their bodies. After all, bread and clothing are the two great essentials of life, and the man who provides them is performing a great service to mankind and has a market that cannot be destroyed.—A. H. E. McDonald, Chief Inspecter of Agriculture.

The Value of Some New Varieties of Oats.

With the early ripening varieties now being bred, the wheat-farmer who is in any case obliged to grow a certain area of oats can give the wheat his first attention and sow his oats after the wheat is in. Formerly it was necessary to sow oats before the wheat in order to get an adequate return.—J. T. Pridham, Plant Breeder.

Farming with a Tank Type Tractor.

K. W. MASTERS, Spicer's Creek *via* Wellington.

ALTHOUGH my experience of tractor farming is limited to the use of one make of tractor, I feel justified in making an attempt to place before those farmers who are interested in tractors the result of four trials conducted by me at my father's farm, which is situated in the Wellington district. It comprises red soil, black soil, sandy loam, stony ridges, sandy patches, and several side hills.

The trials consisted of ploughing, ploughing and harrowing combined, tank cleaning, and harvesting.

PLOUGHING TRIAL.

Time, 36 hours; area ploughed, 40 acres: load, 5-furrow Martin stump-jump disc plough: 8 inches cut, 5 inches deep.

	£	s.	d.
Kerosene distillate, 54 gallons at 1s 10d per gallon	4	19	0
Valvoline cylinder oil, 1¼ gallons at 12s. 6d per gallon	0	16	8
Tractor grease	0	2	0
Benzine for starting	0	1	0
Total	£5	18	8

Total cost for fuel and lubrication, 2s. 11·6d. per acre.

PLOUGHING AND HARROWING COMBINED.

Time, 30 hours 12 minutes; area covered, 37 acres; load, 6-furrow I.H.C. stump-jump mould-board plough; 8 inches cut, 4½ inches deep: harrows, 4 feet 8 inches wide, hitched to plough, not direct to tractor.

	£	s.	d.
Kerosene distillate, 57 gallons at 1s. 10d. per gallon	5	4	6
Valvoline oil, 1 gallon at 12s. 6d. per gallon	0	12	6
Grease	0	2	6
Benzine	0	1	0
Total	£6	0	0

Total cost for fuel and lubrication, 3s. 2·92d. per acre.

TANK CLEANING.

Load, Meadowbank 3-wheel scoop; yard capacity; tank bottom rather boggy, scoop wheels skidding most of the time: 60 feet cable rope was used between tractor and scoop after the top of the mud had been removed: batter, 1 in 3; vertical depth, 9 feet: 417 yards removed (mud).

	£	s.	d.
Kerosene, 51 gallons at 1s. 7d. per gallon	4	0	9
Valvoline, 2 gallons at 12s. 6d. per gallon	1	5	0
Grease and benzine	0	7	0
Total	£5	12	9

Total cost of fuel and lubrication, 3·22d. per yard (cubic).

HARVESTING.

Load, 8 feet Massey-Harris header: test covered, 10 hours: area covered, 18 acres.

	£	s	d
Kerosene, 16 gallons at 1s. 7d. per gallon	1	5	4
Valvoline, ⅓ gallon (accordingly)	0	4	2
Benzine and grease	0	2	0
Total	£1	11	6

Total cost of fuel and lubrication, 1s. 9d. per acre.

Wages have not been calculated in the above trials.

Duplicates amounted to 29s. 8d. for a period of seven months' work. Depreciation is not allowed for in the figures, as it depends to a great extent upon the efficiency of the operator. The water used was not measured, but the consumption on these tests was very small, the main portion being consumed by the clarifier, as the greater part of the work was conducted under the droughty conditions existing for the greater portion of the year The average farmer does not realise the importance of a clarifier on a tractor. Only clean air can enter the carburettor when a clarifier is attached.

Speeds, according to work, must be judged by the operator. Cooling is very efficient, the radiator water never boils unless the fan belt slips or breaks.

The tractor replaces, on this farm, ten horses, exerts a drawbar pull of over 2,000 lb., and exerts 27 horse-power on the pulley. It has proved itself superior to horses in all our farm work, particularly at harvesting.

Some farmers, and even others whose work does not entail the use of mechanical power, argue that the tracks will wear out rapidly in a dry season, but proper attention will prove the tracks far superior to wheels for agricultural work. Wheels may be better adapted to hauling on macadamised roads, but hauling does not constitute the main portion of agricultural work.

What the Boys and Girls Did.

During 1921 over 7,000,000 dollars' worth of products were produced by the club boys and girls of the United States, the actual cost of production, plus the cost of leadership, being only 4,500,000 dollars: results, 2,500,000 dollars clear profit. It is fair to assume that most of this wealth would not have been created had it not been for club work. In addition to the immediate money value, the boys and girls gave 20,000 public demonstrations, annually attended by over half a million farmers and farm wives, thereby serving their communities, spreading the influence of the better practices, and adding to the wealth of the community for all time.

As an example of the influence that is being brought to bear to improve the methods employed, boys and girls of twenty-six states grew an average of 179 bushels of potatoes per acre, while the average for the same states for the same year for all potato production was 115 bushels, thereby showing all the farmers in those states with whom they came in contact how larger profits can be made. This difference of 64 bushels per acre applied to our 3,929,C00 acres utilised for potato production in 1920, at the usual price per bushel, runs into millions of dollars of wealth which could have been—but was not—produced.—G. L. Noble, in *The Banker-Farmer*

Seeds and Good Crops.

The first essential toward the production of a first-class crop is to use only first-class seeds. Such a description involves—(*a*) Variety best suited to the land; (*b*) good strain; (*c*) high purity; (*d*) good germination; (*e*) suitable country of origin.—Leslie E. Corby, N.D.A., in *The Journal of the Ministry of Agriculture.*

Experiments with Arsenical Dipping Fluids.

LIONEL COHEN, F.C.S., Chemist, Tick Board of Control.

DURING the period that has elapsed since the cattle tick (*Margaropus australis*, or *Boophilus australis*) first made its presence felt in the State of New South Wales, the treatment of infested or suspected stock with arsenical solutions, together with a system of quarantine, has been the method adopted by the Government with a view to the eradication of the pest.

For more than a century certain arsenical fluids had been employed in various countries with great success for the destruction of parasites on sheep. When, therefore, the relationship between Texas fever and the cattle tick was definitely established by Kilborne, of the United States Bureau of Agriculture, in 1889, and consequently the problem of tick-eradication became increasingly urgent, after many experiments with various oil sprays and dips, solutions of arsenic were tried and found to be efficacious.

According to Stewart, the first application of arsenical solutions to cattle tick was by Mr. Mark Christian, near Rockhampton, Q., in 1895.

The dipping formula adopted by the Queensland Stock Department, and subsequently by that of New South Wales, is as follows:—

Arsenic (Arsenious oxide)	8 lb.
Washing soda	12 lb.
Common hard soap	2 lb.
Stockholm tar	1 gallon.
Water, to	400 gallons.

This fluid was originally prepared by boiling the ingredients together in tanks at the dipping-bath. In view of the manifest disadvantages attached to the process, recently introduced proprietary mixtures were purchased, which, though fairly efficacious, were found in one respect or another to differ from the Departmental formula, besides being liable to fluctuations in arsenical strength.

Finally, in 1914, the New South Wales Department began manufacturing a concentrated medicament precisely in accordance with their own prescription. As it was found impossible to ensure the homogeneity of such a concentrated mixture in a single fluid it was necessary to segregate the saline from the saponaceous ingredients by keeping them in separate containers. When the expression "emulsion" occurs in the description of the following experiments the mixture of soap and pure Stockholm tar, in accordance with the Departmental formula, is to be understood.

In those portions of the United States where cattle ticks are prevalent, treatment of stock with oils and with proprietary mixtures was resorted to

until about 1911, when the Federal authorities of that country took over systematic eradication work and adopted the Queensland formula *in globo*, even to the same percentage of arsenious oxide. This was found to give excellent results under the supervision of the Bureau of Animal Industry, and still constitutes the standard in official operations.

In South Africa a great deal is used of a proprietary medicament containing between 6 lb. and 7 lb. arsenious oxide, together with a relatively large proportion of emulsified coal-tar products. For years very good results have been found to attend the use of this preparation at the arsenical strength specified.

The properties necessary in a perfect dipping fluid are—(1) that it should kill all the ticks on the cattle at the time of treatment, and (2) that it should have no deleterious effect on the cattle themselves. The first desideratum leads to the question of the variety and life-history of the ticks to be destroyed with a view to the ultimate elimination of the diseases disseminated thereby.

In South Africa three distinct virulent diseases of cattle are spread by ticks of various kinds, viz.: East Coast fever, by five varieties of "brown tick," and redwater (Texas fever), and also gall-sickness, by the "blue tick." In addition, a disease of sheep, goats, and calves, known as heart-water, is due to an organism injected by the "bont tick." In the United States and in Australia the only known tick-borne disease is Texas fever, and one variety of tick alone is capable of transmitting it, viz., the cattle tick, which is practically identical with the African blue tick. Now whereas the latter spends the whole of its period of growth on one host, the other ticks enumerated require two or three separate hosts to complete their life-cycle, that is to say, they spend a considerable portion of their active existence on the ground, so that an important distinction becomes evident between tick-eradication work in South Africa and in Australia owing to the much greater complications in the former territory, due to the several varieties of disease-transmitting ticks and their varying life-histories.

Nevertheless, excellent work has been and is being done there with fluids containing less than two parts arsenious oxide per 1,000. But in order to ensure the destruction of those species of ticks that periodically detach themselves from their hosts (*e.g.*, at intervals of from five to seven days) it is found necessary to treat the cattle at much shorter intervals than is required in the case of those ticks that remain attached to the same animal for three weeks or more. Experience, however, has demonstrated that the repeated application of fluids containing the above proportion of arsenic often results in injury to the skin of the animal, and experiments made with weaker preparations at shorter intervals have shown that the ticks, and consequently tick-borne diseases, can be successfully exterminated by those means.

Watkins-Pitchford, of Natal, stamped out East Coast fever from certain localities by dipping all stock every three days in a fluid containing only ·08 per cent. arsenious oxide (3·2 lb. per 400 gallons). H. E. Laws proved

by means of experiments in 1910 that twenty continuous sprayings at five-day intervals with an emulsified fluid containing ·125 per cent. arsenious oxide (5 lb. per 400 gallons), killed the various species of ticks present without any harmful results to the cattle.

Although the experience of the New South Wales Stock Branch has failed to establish any definite relationship between "scalding" of cattle and the arsenical strength of medicament, and has found the evidence in cases of skin injuries to point strongly to climatic conditions and individual idiosyncrasy, still there are indications that a reduction in the standard of arsenical strength would be desirable, if only from the viewpoint of economy. Further, as the result of regular chemical examination of all baths in New South Wales, data have accumulated which tend to show that the Departmental medicament is effective at a considerably lower strength than two parts of arsenic per 1,000.

In view, also, of the conflicting evidence as to the desirability or otherwise of emulsion, and its effect on the tick-killing power of the fluid and on the skin of the animal, it seemed desirable that experiments should be undertaken to test these questions under New South Wales conditions.

Since the general introduction of arsenical dipping-fluids in various parts of the world, it has been observed that the original arsenious oxide in many baths tends to become converted by oxidation into arsenic oxide. This more highly oxidised form of arsenic was understood to have considerably less effect on the tick than in its original condition, but the experiments on the subject cannot be said to have established anything very definite in regard to the relative tick-killing power of the several forms. True, Cooper and Laws came to the conclusion that arsenic oxide (arsenate) may be assigned about half the "tickicide" value of arsenious oxide (arsenite), but the published results were not as conclusive as could be desired.

The principal obstacle in the way of experiments on ticks in New South Wales being the scarcity of tick-infested cattle, an opportunity arose in the latter part of 1916 of operating on a Queensland herd, the property of the late Mr. T. Campbell, of Murwillumbah, who was at that time a member of the New South Wales Tick Advisory Board. By the courtesy of this gentleman we were enabled to carry out the experiments hereinafter described on his property, "Helen's Vale," Oxenford, South Queensland, in 1916, 1917, and 1920.

The First Experiment at Oxenford.

The object of the first experiments conducted at Oxenford in December, 1916, was to determine what practical allowance might be made for that portion of the original arsenite converted into arsenate, when rectifying a dip that has become weak through oxidation.

From the conclusions of Cooper and Laws that the tick-killing power of arsenate is approximately half that of arsenite, it would follow that a solution containing, for example, 6 lb. arsenious oxide and 4 lb. arsenic oxide per 400 gallons, would be quite as efficacious as one containing 8 lb.

arseuious oxide alone. To test this, five different solutions were prepared, which, though containing varying proportions of the two oxides, ought all to have the same tick-killing power according to the above theory.

The exact strengths as shown by analyisis of these fluids when used, expressed in pounds per 400 gallons, were as follows:—

	Arsenite in terms of As_2O_3.	Arsenate in terms of As_2O_5.
(*a*) Control	7·9 (approximately 8)	0·2 (approximately 0)
(*b*) ...	6·9 (,, 7)	2·3 (,, 2)
(*c*) .. .	5·9 (,, 6)	4·1 (,, 4)
(*d*)	4·9 (,, 5)	6·4 (,, 6)
(*e*)	3·9 (,, 4)	8·2 (,, 8)

To each brew emulsion was also added in the proportion of 1 to 400 of fluid.

Two tick-infested dairy cows were carefully sprayed by means of a hand-pump with each solution, and the effects noted from day to day. The results are set forth serially below:—

JERSEY COW, BRANDED A.—Control animal. *Solution (a), approx. 8 lb. arsenite only.* Before spraying on 15th December, twenty-eight adult female ticks were marked, and these were all dead or had disappeared on 18th. On 16th, numbers of previously invisible nymphs now swollen up and noticeable. On 19th, six unaffected mature, but not engorged, females previously unseen, and one active male taken from escutcheon and udder. Cow quite unaffected. Carried hundreds of larval and nymphal ticks that subsequently dried up and were brushed off by the hand on 18th.

LARGE WHITE COW, BRANDED A1.—Control animal. *Solution (a), approx. 8 lb. arsenite only.* Before spraying on 15th December twenty-four adult ticks were marked, and these were all dead or had disappeared on 19th. Cow quite unaffected throughout. On 17th, one previously unnoted, but affected, found behind point of left shoulder, but gone next day. On 18th, there were observed for the first time one tick on outside left forearm; one on left thigh, very swollen; one behind left forearm, swollen; these three ticks had disappeared on 19th. On 19th, one adult female removed from right thigh, unaffected, very conspicuous, not seen previously.

RED COW, BRANDED B.—*Sprayed with (b), approximately 7 lb. arsenite and 2 lb. arsenate.* Before spraying on 15th December twenty-seven ticks were marked, and these had all disappeared or were dead on 19th. On 16th, one adult observed close to left eye, dropped off next day. On 17th, one large adult observed near left nostril, had dropped off next day. On 18th, dead male found on shoulder, and one live male firmly attached to beast amongst many dead and dying nymphs. Small female, previously unseen now noticeable on outside left flank, swollen: dead next day.

JERSEY COW, BRANDED B1.—*Sprayed with (b), approximately 7 lb. arsenite and 2 lb. arsenate.* Before spraying on 15th December, twenty-nine ticks were marked, and these were all dead or had disappeared on 19th. On 16th, cow unaffected. A few ticks apparently unaffected. On 17th, nearly engorged tick appeared centre of left hip, previously unnoticed, gone next day: one on left butt. tail marked, gone next day: one behind left shoulder swollen, marked, gone next day. On 19th, very slight scurfiness on rubbing hair of left side of neck.

YELLOW AND WHITE COW, BRANDED C.—*Sprayed with (c), approximately 6 lb. arsenite and 4 lb. arsenate.*—Before spraying on 15th December fifteen ticks marked, and these had all disappeared or were dead on 18th. Cow highly infested with nymphs; 2-inch scratch on left buttock. On 16th, cow unaffected, scratch healing rapidly. On 17th, skin on escutcheon appeared wrinkled; two ticks on left neck marked, one dead next day, other on 19th. On 18th, one seen behind left ear very sick; dead next day; one live active male firmly attached to left hip, removed. On 19th, one adult female on left flank quite unaffected, not seen yesterday.

RED COW, BRANDED C1.—*Sprayed with (c), approximately 6 lb. arsenite and 4 lb. arsenate.* Before spraying on 15th December, thirty-four ticks marked, and these had all disappeared or were dead on 19th. On 16th, cow unaffected. On 17th, one dead behind left shoulder, one near left jaw affected, both gone next day. On 18th, one large under right flank affected, one large on right brisket marked, both gone next day. A large scratch on right side healed completely during observations.

RED COW, BRANDED D.—*Sprayed with (d), approximately 5 lb. arsenite and 6 lb. arsenate.* Before spraying on 15th December sixteen ticks were marked, and these had all disappeared or were dead on 19th. Cow struggled violently in bails while spraying, &c. On 16th, slightly wrinkled on neck. On 17th, above effect scarcely noticeable. On 18th, one small adult centre right ribs affected, removed practically dead next day. Slight scurfiness on about 4 square inches on thighs, still there next day. On 19th, an adult noted on right flank, quite unaffected; not seen previous day.

ROAN COW, BRANDED D1.—*Sprayed with (d), approximately 5 lb. arsenite and 6 lb. arsenate.* Before spraying on 15th December, forty-five ticks were marked, and these were all dead or had disappeared on 19th. On 16th, effect of spray on ticks very noticeable. On 18th, one on left hip noted, gone next day; one healthy, one sick on butt tail, both gone next day; one large on left neck, nearly dead, dead next day. On 19th, two healthy adult female ticks removed, one from side of udder, other from nostril, previously escaped observation.

BROWN JERSEY COW, BRANDED E.—*Sprayed with (e), approximately 4 lb. arsenite and 8 lb. arsenate.* Before spraying on 15th December, forty-seven ticks were marked, and these were all dead or had disappeared on 19th. On 16th, cow unaffected. On 17th, small unnoted ticks on belly, now puffed up and noticeable. Effect of spray very marked. On 18th, one live active male removed, some dozen dead males on neck amongst young dead females, firmly attached to beast. On 19th, three live adult females removed, previously unseen.

SPOTTED COW, BRANDED E1. *Sprayed with (e), approximately 4 lb. arsenite and 8 lb. arsenate.* Before spraying on 15th December eleven ticks were marked, and these were all dead or had disappeared on 18th. This cow fairly clean. On 16th, cow unaffected. On 17th, one in front of left shoulder found, very swollen; dead on 19th. On 18th, one dead male removed, also one live active male not attached.

Warm, seasonable weather conditions prevailed throughout the experiment. A perusal of the records at once discloses that all the five fluids appear to have been equally efficacious in regard to their tick-destroying power.

No detrimental effect whatever could in any case be observed on the cows, which were milked as usual twice daily from the time of spraying. The dairyman, Mr. J. Hession, stated that no diminution in the milk yield of the treated cows could be detected.

The marked ticks constitute all the adults observed by Mr. Inspector Glennie by close examination in the bails.

A remarkable feature of the results is the survival of a number of adult females, whose presence, for reasons not quite clear at the time, had not previously been noticed. This was subsequently shown to be due to the remarkably rapid growth of young adults at certain periods. It will be necessary to refer to this matter again later on.

The experiment appeared to support the conclusions of Cooper and Laws, and therefore an allowance was accordingly made for the tickicide effect of arsenate in all oxidised baths.

However, in order to ascertain whether the efficacy of all these fluids might not be due to the arsenite itself contained therein, it appeared desirable to determine, if possible, the minimum percentage of arsenite alone necessary to produce similar results. With this end in view, a further experiment was made at Oxenford, in May-June, 1917.

The Second Experiment.

In this experiment sixteen head of mixed cattle (heifers and dry cows) were sprayed, as previously, with fluids prepared at the following strengths (in pounds per 400 gallons):—

A and A1—8 lb. arsenious oxide, plus 1 gallon emulsion.
B and B1—8 lb. arsenious oxide, alone.
C and C1—7 lb. arsenious oxide, plus 7 pints emulsion.
D and D1—7 lb. arsenious oxide, alone.
E and E1—6 lb. arsenious oxide, plus 6 pints emulsion.
F and F1—6 lb. arsenious oxide, alone.
H and H1—5 lb. arsenious oxide, plus 5 pints emulsion.
I and I1—5 lb. arsenious oxide, alone.

The preliminary arrangements were unexpectedly protracted, and it was therefore only possible to spray two of the cattle (A and A1) on the first day, 30th May. The balance were treated on the 31st May, and daily observations were made up to and including the 5th June.

The cattle in this work were for the most part very heavily infested, in great contrast to those used in December for the oxidation experiments. It was at once seen that counting the ticks would be a practical impossibility. Some of the cattle carried thousands of the parasites, the escutcheon and adjacent parts being in nearly all instances literally swarming with ticks in each stage of development.

It was therefore decided to wait till the majority had been destroyed by the treatment, and then commence taking notes of any individual ticks that might survive longer than the rest.

The daily observations of the treated cattle are tabulated below:—

SERIES I.—*8 lb. arsenious oxide per 400 gallons.*

RED COW, WHITE FLANKS, BRANDED A.—*Sprayed 30th May, with 8 lb. As_2O_3 and 1 gallon emulsion per 400 gallons.* Grossly infested with ticks in all stages, especially on escutcheon and inside thighs. 31st May: A few ticks apparently affected, mostly unaffected. 1st June: Mostly affected, some unaffected. 2nd June: All apparently affected. 3rd June: All on escutcheon apparently dead or dropped off, a few on outside thighs still unaffected. 4th June: Most adults yesterday unaffected now swollen up, except about ten. 5th June: All affected or dead except two, doubtful.

RED COW, WHITE ON HIPS, BRANDED A1.—Infestation same as A. Similar treatment. 31st May: A few ticks apparently affected, mostly unaffected. 1st June: Majority affected, few nymphs dead on escutcheon. 2nd June: Nymphs dried up, with one or two exceptions all adults apparently affected. 3rd June: All very sick or dead. 4th June: Unable to detect any showing no sign of effect. 5th June: Only one, near anus, condition doubtful.

RED AND WHITE COW, BRANDED B.—*Sprayed 31st May with 8 lb. arsenious oxide per 400 gallons, no emulsion.* Hair long. Heavily infested with ticks in all stages, especially on escutcheon and thighs. Escutcheon rather scabby. 1st June: Mostly affected, some dead. 2nd June: Mostly affected, some apparently unaffected. 3rd June: Two apparently sound, engorged, females removed for observation. All on hairless parts appeared dead or affected.

Some among hair apparently not. 4th June: Still some mature ticks showing little or no effect, but many swollen since yesterday. Two mature on right hip marked, very doubtful. 5th June: Marked ticks disappeared, still two more apparently unaffected.

BRINDLE COW, BRANDED B1.—Infestation and treatment same as in case of B. 1st June: Nymphs nearly all affected, adults not noticeably so. 2nd June: Mostly affected, with some exceptions. Very few engorged ticks now left. 3rd June: All showing severe symptoms. 4th June: Two marked near left hip apparently still unaffected. 5th June: One marked tick gone, the other sick. All dead or sick.

SERIES II.—7 *lb. arsenious oxide per* 400 *gallons.*

BLACK JERSEY HEIFER, BRANDED C.—*Sprayed 31st May with 7 lb. arsenious oxide and 7 pints emulsion per 400 gallons.* Fairly heavily infested, notably on brisket, in crutch, and on thighs. 1st June: A few affected. 2nd June: Very few ticks left, these mostly affected. For the most part dead on brisket. 3rd June: Four nearly full-grown on right base tail, one on left, and several others showing no symptoms. 4th June: Three adults remain apparently sound. 5th June: Yesterday's three now showing slight symptoms.

SMALL YELLOW HEIFER, BRANDED C1.—Treatment similar to C. Not so heavily infested as C. 1st June: Slight effect noticeable. 2nd June: Mostly affected. 3rd June: Three apparently sound, mostly affected or dead. 4th June: One near tail and two near left brand marked, apparently sound. 5th June: Two near brand still no symptoms. One near tail disappeared, one other doubtful. Some still alive, but sick.

RED YEARLING HEIFER, BRANDED D.—*Sprayed 31st May with 7 lb arsenious oxide per 400 gallons, no emulsion.* Very heavily infested. 1st June: No noticeable effect. 2nd June: Mostly affected. 3rd June: Three engorged females showing effect removed for observation. All on escutcheon and thighs affected. 4th June: Four adults marked apparently sound, one engorged female caught while dropping off. (Lived for some days; began to shrivel up on 12th June without having oviposited.) 5th June: One of yesterday's four showed no symptoms. Others gone or sick. Five or six showing only slight effect.

RED AND WHITE HEIFER, BRANDED D1.—Nearly as heavily infested as D. Very thick on left thigh. Same treatment as D. 1st June: Nymphs noticeably affected. 2nd June: Effects very noticeable, more so than with D. 3rd June: Some young adults in long hair apparently normal. 4th June: No change in these. Clusters on each thigh marked. 5th June: One cluster still no symptoms. In other only one remaining. Still two or three along spine apparently healthy.

SERIES III.—6 *lb. arsenious oxide per* 400 *gallons.*

RED HEIFER, BRANDED E.—*Sprayed 31st May with 6 lb. As_2O_3 and 6 pints emulsion per 400 gallons.* Infestation fairly heavy. 1st June: No noticeable effect. 2nd June: Nymphs dead, most others affected. No engorged ticks to be seen. 3rd June: Some apparently healthy on outside thighs, otherwise treatment effective. An engorged female marked on front of right hip. 4th June: Marked tick gone. Three others marked doubtful. 5th June: Two of yesterday's gone. One still there. Two apparently unaffected on right thigh.

BROWN HEIFER, BRANDED E1.—Treatment similar to E. Thick coat. Not so heavily infested as E. 1st June: Only two nymphs noticeably affected. 2nd June: All showing symptoms, most nymphs dead. 3rd June: Engorged female apparently sound, on back of right thigh, also two small adults on base of neck. All others affected. 4th June: Marked ticks badly affected. One doubtful outside left thigh marked. One large female and two nymphs, affected in corner of right eye. 5th June: Mature tick gone from eye, others sick.

BLACK JERSEY HEIFER, BRANDED F.—*Sprayed 31st May with 6 lb. As_2O_3 per 400 gallons, no emulsion.* Grossly infested. 1st June: No noticeable effect. 2nd June: Mostly affected. 3rd June: Several engorged females and small adults apparently unaffected, but most show severe symptoms. 4th June:

Two adults outside left thigh, and one engorged on belly near left flank marked, apparently unaffected. 5th June: Marked ticks gone. Three more apparently unaffected ticks observed.

SPOTTED HEIFER, BRANDED F1. Treatment similar to F. Thick coat. Rather lightly infested. 1st June: No effect noticeable. 2nd June: Mostly affected. 3rd June: All apparently affected. 4th June: No unaffected ticks observable. 5th June: Two young adults on left thigh apparently unaffected.

SERIES IV.—5 *lb. arsenious oxide per* 400 *gallons.*

BALDY HEIFER, BRANDED H.—*Sprayed 31st May with 5 lb.* As_2O_3 *per* 400 *gallons and 5 pints emulsion.* Lightly infested, fairly heavy inside thighs 1st June: Slight signs of effect. 2nd June About same as others, some nymphs still apparently alive. 3rd June. All apparently affected. 4th June: One small adult behind left shoulder and one on left jaw apparently unaffected, marked, rest affected. 5th June: Marked ticks gone, no unaffected ticks visible.

BLACK AND BROWN COW, BRANDED H1 Same treatment as H. Heavily infested. 1st June. Two on escutcheon showing symptoms. 2nd June: Larvae and nymphs mostly dead, mature ticks affected. 3rd June: All on hairless parts seemed badly affected. Several small adults on left hip apparently sound. One nearly engorged removed for observation also apparently unaffected. 4th June. Six apparently unaffected marked. 5th June: All these affected, two of them dried up. Three young adults near vulva apparently unaffected.

YELLOW HEIFER, WHITE STAR, BRANDED I.—*Sprayed 31st May, afternoon, with 5 lb.* As_2O_3 *per* 400 *gallons, no emulsion.* Rather lightly infested. 1st June: Not noticeably affected. 2nd June: Very few left Two or three large adults and most others affected 3rd June: Nymphs dead Two mature females on flanks apparently unaffected. 4th June: One on left butt of tail three under left flank, and two on left ribs apparently unaffected. 5th June One on butt of tail slightly affected, one on ribs gone, one slightly affected, three under flanks affected.

YELLOW HEIFER, BRANDED I1.—Treatment similar to I. Infestation similar to I 1st June: Not affected 2nd June: Slightly affected 3rd June: Nymphs dead. 4th June: All affected, except possibly one behind right hip, one left butt of tail, one under left flank and one left of spine near shoulder. 5th June: Tick gone from behind right hip, the rest sick.

A heavy shower of an hour's duration fell on the afternoon of 2nd June. During the day time the weather was sunny and mild for the time of year, but the nights were cold to frosty.

It will be seen from a comparison of the results that the action of the medicament was in all cases much slower than in the December experiment. This may be due to the cold weather, since low temperatures, as is well known, tend generally to retard chemical and chemico-physical action.

Although most of the cattle were rather wild at the commencement, and had to be roped before inspection and treatment, no injurious effect was at any time discernible upon them, nor was any reported by Mr. Hession.

A curious exception to the heavily-infested condition of the herd was observed in the case of a Jersey cow, which, although it had not been dipped for several months, was found to be practically free from ticks at the first inspection. The animal bore abundant evidence of having at some previous time been grossly infested, and later on, four or five days after the first inspection, it began to show fairly heavy infestation of larval ticks. This cow was examined daily to see whether any adult ticks would appear, with negative results.

The outstanding feature of this experiment is the fact that all the fluids used have been about equally effective. It will be seen that the emulsion has not appreciably augmented the tick-killing power of the various fluids, nor hastened their action. At the same time, a considerable difference between the wetting effect of the emulsified and non-emulsified medicament was noticeable in all cases. Much more of the latter was required to thoroughly spray a beast than of the former. As Assistant Purvis expressed it, "the emulsified fluid is easier to use." The retention of emulsion is therefore indicated, particularly in the case of hurried or perfunctory treatment of cattle, since by reducing the surface-tension of the fluid, its employment ensures the wetting of parts that do not actually come into contact with the jet of fluid from the spray, and produces a uniform film of liquid over the naturally greasy skin and hair.

It was generally observed that the larval and nymphal ticks were the first to become affected or die, then the semi-engorged adults, and lastly the newly-matured adults. A few of the latter successfully resist the action of the medicament altogether, and in these cases it was noticed that they had just passed through the second moult, in fact, the discarded skin was in some cases still adhering.

Further opportunities for the resumption of field experiments did not eventuate until March, 1920, when additional trials were made as to the optimum requirements of arsenious oxide, dipping, however, being substituted for spraying. In addition to this, an attempt was made to study the effect upon the ticks of various strengths of arsenic oxide alone.

(To be continued.)

Rotation in Relation to Wheat-growing.

More interest is nowadays being shown in crop rotation for wheat districts. Experiments are at present in process of being carried out by the Department which will give a definite lead under this heading in many districts. It will be demonstrated by these experiments that by the introduction of fodder crops for stock feeding a more profitable system of mixed farming can be established.—A. H. E. McDonald, Chief Inspector of Agriculture.

What Fertilisers Can Do for Maize.

Fertiliser experiments carried out by the Department with maize have given some striking results, a yield of over 110 bushels per acre without fertiliser being increased 20 bushels by its application. This gives the lie to the opinion that is sometimes heard that maize land that will give a 100-bushel crop does not need manuring.—H. Wenholz, Special Agricultural Instructor.

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Spiny or Prickly Spider Flower (*Cleome spinosa* Jacq.).

(*Capparidaceæ:* Caper Family).

Botanical name.—*Cleome*, from *kleio*, to shut, in allusion to the parts of the flower; a name adopted by Linnæus from Theodosius; *spinosa*, spiny, in reference to the spines at the base of the leaf stalk.

Common name.—Spiny or Prickly Spider Flower. The long filaments and anthers give the flower a spidery appearance.

Popular description.—A rather strong-growing plant, 2 to 5 feet high, glandular and clammy-hairy all over, emitting a somewhat fœtid odour. Leaves divided into three to seven leaflets, 2 to 4 inches long; leaf stalks spiny, with two larger spines at the base. Flowers white, pale rose, or purple, on long stalks, one inch broad or more, forming a long terminal raceme 4 to 16 inches long. Pods narrow, 3 to 4 inches long, containing numerous rough, kidney-shaped seeds.

Botanical description.—Glandular, pubescent, annual or biennial herbs, 2 to 5 feet high, leaves three to seven, foliolate, the lower long petioled, the upper shorter petioled, or nearly sessile, passing into the simple lanceolate or cordate-ovate bracts of the raceme. Petioles spiny; stipular spines, two at the base of the petiole; deciduous prickles sometimes on the petioles. Leaflets lanceolate to broadly lanceolate, 3–9 cm. long; petioles 2–11 cm. long; racemes 1–4 dm. long. Flowers white, pale rose, or purple, sometimes trimorphic on the same plant, about 2 cm. long. Petals obovate, the claw nearly as long as the limb. Stamens six, crimson, generally long exserted. Ovary much shorter than its stalk, the gynophore in the flower. Capsules linear cylindrical, sometimes twice as long as the gynophore, which is generally much longer than the pedicel. Seeds reniform, rugose, nearly 2 mm. in diameter.

Where found.—Tropical and sub-tropical America, British West Indian Islands, where it is a common and very variable weed. Within the last two or three years it has made its appearance in this State at Taree and Camden Haven River, North Coast. It was introduced into this country as an ornamental garden plant, and has now become naturalised both in New South Wales and Queensland.

Nature of the plant.—The Prickly Spider Flower is a class of plant which is likely to spread and become a nuisance if not checked. Owing to its clammy nature it is rejected by stock, and as it is a prolific seeder and a rapid grower it is likely to make great headway, especially in the fertile districts of the North Coast.

Useful or otherwise.—The flowers of this and other species are said to yield a considerable quantity of nectar, which the bees convert into honey of fair quality. But the plant should not be encouraged for that purpose, at least in certain districts, as the risk of it becoming obnoxious is too great, especially in the coastal districts, where the soil and climatic conditions are congenial to its development.

Spiny or Prickly Spider Flower (*Cleome spinosa* Jacq.)

A closely allied species, *C. viscosa*, is used medicinally in India, and also for food. The seeds yield a light olive-green-coloured oil. They are also used in all complaints in which mustard is used, and the leaves are applied to the skin in the form of a poultice

Means of control.—Being a plant of one or two years' duration, and of a somewhat woody nature, it is best to cut it off in the seedling stage, or before it produces flowers. When the pods are ripe they burst and scatter the seeds about, and a large number of seeds adhere to the clammy leaves and branches of the plant when in quite a green state, so that any large plants that have reached the flowering and fruiting stage should be carefully cut out and burnt.

Five-wounded Catchfly (*Silene quinquevulnera* L.)

(*Caryophyllaceae*. Clove or Pink Family.)

Botanical name. *Silene* said to be derived from *sialon*, in allusion to the viscid frothy moisture on the stalks of many species, by which flies of the smaller kinds are entrapped, hence the English name of the genus Catchfly; *quinquevulnera*, the Latin name for the five wounds or crimson spots, which resemble a drop of blood in the centre of each petal.

Popular description. A small, erect, slightly hairy, viscid plant, 6 to 18 inches high, with narrow leaves. Flowers small, with five petals, each petal with a dark crimson spot in the middle and pale pink borders. Seed-vessels on short stalks, urn-shaped, protected by the hairy, ten-ribbed calyx, opening at the top into five or six small curved teeth. Seeds numerous, small, black and rough, somewhat resembling grains of gunpowder. Flowers and seeds from October to December, according to locality.

Botanical description. A slender, sparsely branched, erect, glandular, pubescent or villose annual, 6 to 18 inches high. Leaves, narrow oblong to narrow lanceolate, the lower ones obtuse, about 2½ cm. long. Inflorescence a secund spike, 3 to 6 inches long, sometimes occupying the greater portion of the plant. Flowers shortly pedicellate, subtended by linear floral leaves; calyx glandular-villose with short teeth, conspicuously ten-ribbed, persistent on the capsule, but adnate at its base only; petals roundish, entire with bicuspidate appendages, deep crimson in the middle, the borders pale pink. Capsules distinctly pedicellate, ovoid to urceolate, or contracted at the top, separating at the apex on maturity into six small, spreading teeth. Seeds small, black, tuberculate.

Where found.—It is a native of Spain, Italy, and France, from whence it has spread to various parts of Europe and Asia; common throughout Great Britain, Channel Isles, and Jamaica. About the year 1855 it made its appearance in New Zealand, and it is now one of the commonest weeds in the Dominion. In New South Wales it has been recorded from Bega, Milton, Stanwell Park, Otford, Mosman Bay, at several places from Milson's Point to Woy Woy, Hawkesbury Agricultural College, Richmond, Boonoo Boonoo, and Walcha. It also occurs in Victoria and Western Australia.

Character as a Weed.—It can be classed as a weed of agriculture, pastures, and waste places. It is similar in appearance and character to the common or French Catchfly, *S. gallica* (figured and described in this *Gazette* for December, 1895, p. 809). Like that plant it frequently invades grain crops generally, and, with other early spring weeds, retards and even chokes out

Five-wounded Catchfly (*Silene quinquevulnera* L.

the young wheat and oats, and other young crops. It is disseminated in many ways, but the most common agencies of distribution are the various kinds of baled hay, lucerne, and other agricultural seeds. Being of a sticky nature, its seeds and seed vessels readily adhere to grazing animals, and are thus distributed near and far.

Economic uses.—At one time this plant was cultivated for its pretty little flowers, but it has long since been discarded for the more showy species, some of which are very beautiful. It does not appear to possess any economic properties, and it cannot even be recommended as a fodder, for its nutritive qualities are very low. For some unaccountable reason stock do not take to it readily when other feed is about, although it does not appear to possess any deleterious properties.

Means of control.—As with all annuals, the prevention of seed production is a sure means of eradication, and this, together with the methodical burning off of seed-laden plants, is recommended. In areas thickly infested with the weed, winter and early spring ploughing, followed by a summer crop, such as maize, will help to get rid of the plant.

Mortgage Credit Business in Germany.

The history and operation of the Landschaften in Germany is the subject of a small publication from the International Institute of Agriculture, Rome. Landschaft is a title given to a federation of local landowners, without distinction of class, which exists for the purpose of providing land credit in their own localities.

The system has grown up from the days of Frederick the Great, having been founded in consequence of the difficulties that successive wars had brought upon the nobility. Since the abolition of feudal rights the term "Landschaft" has acquired a wider significance. The systems vary in different localities, though the diversity appears mainly in the external organisation of the various institutions. In some cases the State province or commune assumes the initiative and carrying on operations on its own guarantee. In other cases, private persons, under the form of a share company trading for profit, administers the system. Others, again, are administered by the parties concerned under co-operative forms, with the object of securing a common advantage. The last is the oldest and the most important.

The ninety pages of this bulletin contain a history of the Landschaften which brings the reader to the following as the conclusion of a valuable little publication:—"By granting credit not liable to repayment on demand, at a low rate, and by putting a check on private mortgages the terms of which were always very burdensome to landowners, the Landschaften did much to bring about the recovery of the agricultural situation, and rendered possible the transition of agriculture from extensive methods to scientific farming. The ruling factor of their action is exclusively the interest of agriculture: thus they hold an important position not only as mortgage banks, but also as agricultural institutions . . . . . There is warrant for expecting a further and a successful development of the Landschaften even in the new Germany."

The Butter of New South Wales compared with that of Denmark and other Countries.

C. PEDERSEN, Senior Dairy Instructor.

IT may be of interest to those connected with the dairying industry and the manufacture of butter in New South Wales to learn of the opinions formed by me as the result of a recent trip to Denmark, and of the comparative values of Australian butter, Danish (supposed to be the world's best), and other countries.

Calling at London *en route*, I made myself known to the London office of a well-known Sussex-street firm, and was allowed to inspect the samples from Australia, New Zealand, Ireland, and Canada which were kept in the store—the bulk being held in freezing works. As the time of the year was near the end of July, only a few lots of Australian butter were on hand unsold, yet these were of fine quality. Though there were some good butters among the Canadian parcels, generally they were irregular in quality, due, it was stated, to the large number of small factories that are being operated in Canada. The Canadian boxes, too, were not as good or as well made as are our Australian.

The Irish butter seen was a poor lot. It had just arrived, and yet it was quite soft and very moist. It was packed in boxes made from Oregon pine, so roughly put together as to give one the impression that it was a first attempt to make boxes. These boxes were of peculiar shape, being a little higher than ours, the same size at the top, but about 3 inches narrower at the bottom: it was claimed for them that they were better to handle, and that it was easier to slip the contents than is the case with the cubical package.

In another London store I saw more Australian butter, and also some Dutch and Danish. The latter two were equal in value, being worth 93 points each: one lot of the Australian ("Baerami" brand) was worth at least 94 points, and the other ("Almond" brand) was worth 93. Although the Dutch and Danish were no better than the Australian, we know that they would sell at a very much higher figure.

On proceeding to Denmark I examined a lot of butter on agents' floors, and also attended a monthly butter show held at the Royal Agricultural College Experiment Laboratory, at which 136 factories competed. After the judging I went through the butters, and was informed of the awards made by the judges. It was a great lesson, yet very disappointing. From what I remember of Danish butters in days gone by, they had good taste and a fine aroma, and were worth from 94 to 96 points. Danish butter to-day does not

reach these points, though it is very uniform and grades from 90 to 93 points. These Danish monthly butter shows have been held for some thirty-eight years, and are similar to those held in this country some years back.

In any comparison between the best of Australian butter and Danish butter at the time it reaches the agents' floors in Sydney and Copenhagen respectively, one is compelled to give the preference to our butter. While the whole of the Danish product grades from 90 to 93 points, we have a large number of factories whose butter is superior, and mostly grades from 93 upwards. If it were possible to hold our good brands where they are and to bring the balance of the factories up to their level the result should be a great increase in the demand and the price on the London market.

One point that struck me forcibly about the Danish butter was that it all had a more or less acid flavour and aroma, that we would consider faulty; yet no notice seems to be taken of it on that side. This acid flavour is no doubt due to the fact that a strong, pure culture has to be used for ripening the cream, which is done in about twenty hours. A starter to do the work in so short a time must be strong and active.

In America I did not see any high-grade butter, not even in the best hotels or the railway dining cars. It all had a strong feed taint, similar to the flavour we so often met with in the early days in New South Wales, when the herds had to feed on rough and tainted food. Owing to the limited time I had in America I could not visit the best dairying districts, and I only visited two factories *en route* from New York to San Francisco, namely, Cheyenne and Wyoming. Nothing could be learned from these; in fact, they would not stand our system of inspection.

When in Copenhagen I looked into the milk trade, and in this branch we can learn something from the Danes, for they are a long way ahead of us in handling and distributing milk for human consumption.

A Sound Conclusion Concerning Dairying.

What success our dairymen will reap in the coming decades will depend very largely upon how they profit from the lessons of the past. This one thing is, however, a sound conclusion: A good dairyman can yet make more money with butter at 30 cents to 35 cents per lb., made from our bred-and-fed-for-production cows that are free from disease and are well cared for, than a scrub-farmer can with poor animals and butter at 50 cents per lb. On the basis of this statement rests securely the future of Wisconsin's greatest agricultural industry.—Circular 149, University of Wisconsin College of Agriculture.

Milo stands out as the best all-round variety of grain sorghum, and this, and also Feterita, can be recommended to farmers for planting in districts too dry for the production of maize grain. The grain forms an excellent substitute for maize, and is relished by all classes of stock.—J. N. Whittet, Agrostologist.

Soldering Work on the Dairy Farm.

O. C. BALLHAUSEN, Dairy Instructor.

AN elementary knowledge of the use of the soldering iron is of particular value to dairy-farmers. No farmer has to use tinware of various descriptions to such an extent, and a knowledge of how to effect minor repairs is very useful. It might almost be considered a necessary part of a dairy-farmer's training, and the old saying that a stitch in time saves nine is as applicable here as in the case of wearing apparel. The work is not difficult, and if a few essential points are observed it is both interesting and profitable.

It is not suggested that the farmer should attempt the more difficult work, which can only be satisfactorily done by the skilled tradesman, but the mending of leaks, the re-tinning of rust spots, the re-fixing of milkcan hoops, &c., are all possible in the hands of the man determined to master the process. It is the continuous neglect of the rough places in tinware that has such a serious effect on milk and cream quality, by affording lodging places for decaying milk and cream. The exposed metal is also attacked by the acid in the cream, and this is responsible for some of the flavour defects in butter. A few drops of solder will quickly rectify these tinware faults.

The Tools Required.

The tools required for a simple outfit are neither numerous nor costly. They consist of soldering irons, some sticks of solder, a suitable flux, an old file or two, a pair of tin snips a small brush for applying the flux, and a small stove for heating the irons. The soldering irons for small work such as the dairy-farmer is most likely to handle should be not less than half-pound weight for the copper portion. Slightly heavier weights are an advantage as the heat will be retained longer in the greater mass of copper. Some irons are pivoted so that they can be arranged to work in difficult positions. It will be found that two irons, one pivoted and the other of the fixed type, will be an advantage. One iron may then be heating while the other is being used, and the work may proceed without delay. It is not advisable to have the irons fitted with too extended points—short-pointed irons are more satisfactory for average work.

The solder used is what is called soft solder. Soft solders are of lead tin alloy, and the common solder mostly used by tinsmiths consists of two parts lead to one part tin, and may be procured at any hardware store. A better solder is made of one part tin to one part of lead, and the best of all soft solders of two parts of tin to one part of lead. Solder should melt at slightly lower temperatures than the metal it unites, and should be capable of alloying with the two surfaces, thus making a complete metallic joint.

The fluxes used vary with the kinds of metals to be united, but no flux is satisfactory unless the utmost chemical cleanliness is observed and the flux properly used. Even if the surfaces to be united have been scraped perfectly clean, unless the flux used is the correct one, and dissolves the film of oxide always present, it will be found that the melted solder will not spread evenly over the surface of the metals. Care in cleaning and fluxing is essential to successful work, and if this point is carefully observed one of the great difficulties many amateurs experience in soldering will have disappeared.

The flux to use for brass, copper, tinplate, block tin, iron, and steel is zinc chloride, or "killed spirits." For iron and steel, ammonium chloride is also used. For galvanised iron, or galvanised steel and zinc, use dilute hydrochloric flux.

The preparation of zinc chloride or killed spirits is not difficult. Procure a couple of ounces of pure hydrochloric or muriatic acid from a chemist, and some clean sheet zinc cuttings. Place the acid in an old china cup or stone jar out of doors, and add a few of the zinc cuttings. After the first violent frothing ceases add the rest of the zinc cuttings, seeing that some of the zinc is still undissolved after the chemical action stops, but removing such portions before use. It is also advisable to strain the liquid. No water should be added. The flux is now ready for use, and it should be kept in a stone or glass vessel and well stoppered when not wanted. If left uncovered any iron or steel tools in the vicinity of the vessel will quickly become very rustry, and it should also be noted that the flux is a very corrosive poison, and should be kept well out of the reach of children.

A brush for applying the flux may be made by inserting some horsehairs into the end of a piece of loosely-folded sheet brass, and then hammering it flat so as to bite the hairs. This brush will last for a long time, and is better than a wooden stick, which soon becomes saturated with fluid.

Zinc chloride flux is corrosive, and all traces should be removed from finished work, particularly food containers, by washing with a solution of washing soda, soap, and water. There is a risk also of the work being corroded unless all the flux is removed. Care should be taken not to apply the flux where solder is not to adhere, as, being a corrosive, it will attack the tinned surface, and may so damage it that a hole will eventually appear.

Any fire can be used for the heating of soldering irons, but to avoid the dirt and tarry substances of an ordinary wood fire a charcoal or coke fire is desirable. A stove for this fire can be easily made from an old oil or paint drum by knocking a few holes in the sides and bottom, and a larger opening for inserting the irons in the fire.

The Process of Soldering.

A soldering iron must be tinned before it can be used: that is, the facets of the copper must be smoothly covered with an even surface of solder. This may be done by heating the iron to a dull red heat, quickly smoothing the facets with an old file, and dipping it for a moment into killed spirits,

afterwards applying a stick of solder and rubbing on a piece of tinplate to evenly spread the solder, which should appear as a bright thin film on the point of the iron. This film should always remain; if the iron is subjected to too great heat the film will be destroyed, and it will be necessary to re-tin the point before the iron can again be used.

It cannot be too strongly emphasised that the greatest cleanliness must be observed for successful soldering. In making a joint or repairing a leak or rust spot the surface must first be cleaned by careful scraping with a knife or other sharp instrument. Grease and dirt can be removed with dilute muratic acid and a piece of clean cotton waste or rag. When quite clean, and after applying the killed spirit flux, the heated iron and a little solder are placed on the part to be soldered. The iron will heat the faulty part, and cause the solder to melt, but care should be taken not to use too much solder, as it will make the work appear rough and unsightly. Small portions of solder can be picked up by applying the heated iron to the solder stick. In the making of a joint, or the "finishing" of a defective one, the iron should be worked up and down to spread the solder evenly, and the heat from the iron will cause it to penetrate the seam.

It should be remembered that in heating the iron it must not be allowed to become too hot. It should not become the least bit red. When hot the point should be wiped off on a piece of bagging, then lightly dipped in the flux to clean it, and when drawn along the work it will be found that the solder will have a tendency to follow the iron, and it can be placed just where desired. It is useless to try to draw the solder with an insufficiently heated iron, as the solder will not flow, and the finished work will appear very rough and lumpy. A good joint cannot be made in this way, and the more solder is used the worse the job looks. An over-hot iron will give the appearance of sand having been mixed with the molten solder, leaving an unsightly and rough surface. A rough surface must be avoided, for it is always difficult to keep clean.

A slight tilt towards the operator should be given the article under repair, so that the melted solder will easily follow the point of the iron. This gives the joint a much neater appearance than if an effort is made to work with the article held quite level, and the solder is not so likely to spread to where it is not required.

In making a joint a certain amount of lap should always be allowed. A butt joint, where the edges of the metal just touch, is not strong, and is likely to fracture along the line of solder if subjected to any strain. With a lap joint the solder, when heated, will penetrate, cover, and unite the opposite faces of the metal. A good joint is really "sweated" together or welded, and this can only be done if the parts fit close together before the solder is applied.

Sometimes it will be found that a hole is too large to be covered with solder, and the molten solder will run through it. A good plan is to place over the hole a small tin disc a little larger than the hole and solder this in, covering the whole with solder, using, of course, killed spirits for the flux.

Rust spots, if not too deeply seated, may be repaired by carefully scraping away all rust until a bright surface is exposed. This should be further cleaned to remove any grease, by wiping off with a cloth moistened with a little raw spirits. Afterwards apply killed spirits on and around the prepared place, and cover over smoothly with a film of solder. If this is carefully done the solder will be as smooth as the surrounding tinned surface, and further rusting will be prevented.

Benzine Cans as Milk Containers.

Frequently benzine cans are converted into buckets, and used for holding milk and cream and for other purposes. These cans are objectionable owing to the grooved seams round the bottom and in the corners, as well as where the top has been cut out. Rust soon forms in these crevices, and as they cannot be easily cleaned they act as lodging-places for decaying milk and cream.

To make these cans suitable receptacles for milk and cream, the grooved and folded seams and the cut seam at the top should be smoothly flushed with solder prior to use. After lightly applying killed spirits to the seams, place a bead of solder in position, and then, resting the heated iron for a moment to melt the solder, draw it gently along the seam. The can should be tilted slightly, so that the solder will more readily follow the iron and fill the seam. The more the solder can be sweated into these seams the better the result, so that it is advisable to heat the metal as much as possible by very slowly moving the heated iron. The pivoted iron is best for this work, as it is much easier to reach the bottom seams with it.

The bottom corners of these improvised cream buckets are the most difficult to keep clean, and a good plan is to melt a little extra solder into these corners to form a smooth triangular-shaped filling. If all the seams are treated in this way a very useful and sanitary dairy utensil will be provided, and the life of the can will be greater.

In refixing loose hoops on cream cans they should first be thoroughly cleaned by the removal of all rust and dirt, and then wiped off with raw spirits to remove any grease. After very lightly covering the inside of the hoops with solder, they may be slipped into position, and soldered in the usual way, using killed spirits as the flux.

A Few other Hints

A very useful little dipper may be made from a two-pound preserved fruit can. The lid should be carefully removed, and any rough edges left by the tin-opener carefully filed smooth with the aid of a half-round file. Care should be taken to preserve the rim round the outside top edge, as this adds strength to the sides. Afterwards the bottom and side seams might be lightly filled with solder and a handle attached. This may be made with a suitable length of tin, having the two edges lapped over a couple of pieces of wire of light gauge. The handle, after being given the desired shape, with the folded edges inside, should first be soldered near the top edge of the can and the lower end about one and a half inches above the bottom edge. This dipper will be found very useful for many purposes about the dairy.

If enamelled ware is to be soldered, first file or scrape away all enamel for a little less than a quarter of an inch round the hole, and file the metal quite bright. Then apply killed spirit flux and lightly cover the metal round the hole with solder. A tin disc slightly larger than the hole should be placed over it and soldered into position, again using killed spirits as the flux.

The foregoing are just a few suggestions as to how a knowledge of soldering may be usefully applied. The tinsmith's assistance is frequently required in other directions on the farm—for the repair of milk vats, water tanks, house guttering, &c.—but often it is hard to obtain, and if the farmer is able to effect the simple repairs mentioned he will be in a correspondingly independent position. Incidentally, the very objectionable use of soap as a repair agent will be done away with.

Some Experiments in the Storage of Lemons.

Personal trials on a small scale with slaked lime dusted over stored fruit as a deterrent of fungus disease prompted Mr. H. Fenter, Kenmore, via Goulburn, to suggest to the Department that it should carry out more extensive investigations on such lines. It was subsequently decided to institute experiments with lemons at Yanco Experiment Farm and Hawkesbury Agricultural College.

At Yanco two cases of fruit were dusted with lime and packed on 8th September, and two cases were packed with untreated fruit. Both lots were examined on 27th September, when the two cases of dusted lemons were found to contain fifteen decayed fruit and the two cases of untreated lemons nineteen decayed fruit. The decayed fruit was removed, and further examination on 21st October discovered nine decayed lemons in the treated lot and forty-two in the untreated lot.

The experiment at the College was slightly elaborated so as to include also tests of lemons (1) coated with vaseline, and (2) dusted with sulphur. The fruit was harvested on 8th August, and treated and packed on 18th August. Examination of the different lots on 19th October disclosed that of the lemons dusted with slaked lime 14·2 per cent. were bad, of those coated with vaseline 14·8 per cent., of those dusted with sulphur 14·4 per cent., and of those only wrapped 17·5 per cent. The decayed fruit was thereupon removed, and the lime and the sulphur removed from the sound fruit that had been so treated, each lot being then left in store until 14th November, when the contents of the cases were again examined. At this date, of 485 lemons dusted with slaked lime 108 more were found to be decayed, of 478 coated with vaseline 147, of 562 dusted with sulphur 213, and of 478 wrapped 108. This made the per centage of decayed fruit from the commencement of the experiment 36 per cent., 45 per cent., 52 per cent., and 40 per cent., respectively.

The liming treatment therefore showed to a slight advantage.

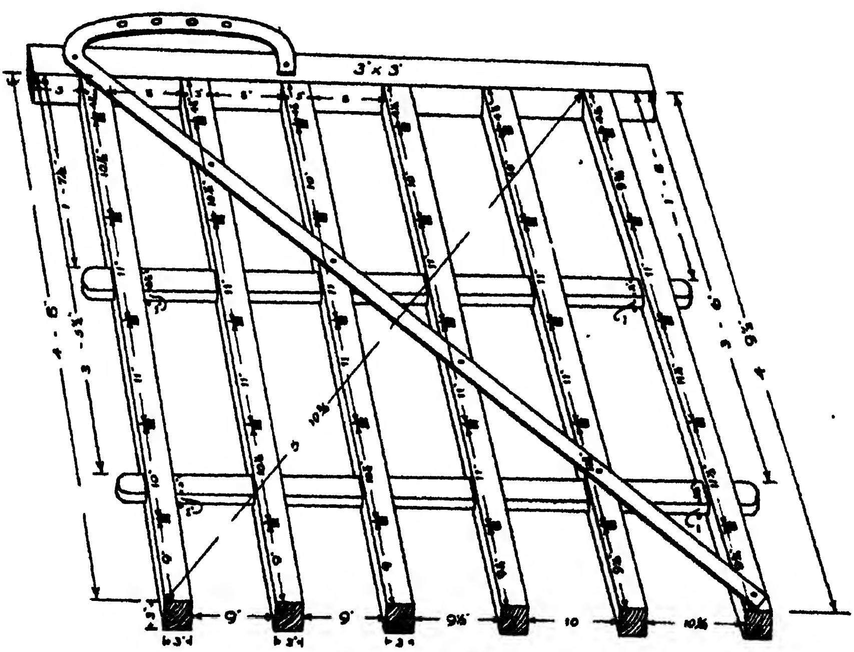
These results suggest that when lemons are clipped, carefully handled, and put away in cases stacked on top of one another, and properly protected, the fruit will keep just as long as when treated with either sulphur or vaseline, but further tests will be carried out next season with lemons picked earlier, viz., just when the fruit is well turned.—W. J. Allen.

A Bull Harrow that Will Not Track.

J. M. PITT, Senior Agricultural Instructor.

THE plan reproduced hereunder is that of a six-bull harrow of a type used in the central coastal district, the advantage claimed for the pattern being that it will not "track." The specification (provided by Mr. A. Brooks, Works Superintendent) is as follows:—

Use well-seasoned spotted gum timbers, prepared to sizes indicated, namely, 3 inches by 3 inches for head and six bulls, and battens tapered from 2½ inches to 2 inches by 1 inch thick for stays. Lay out the timbers on the floor and over each other—that is, the head first, the bulls over the head, and the



SCALE 1 - 1'-0.

stays over the bulls, all spaced as shown and marked. Mark the lines across the timbers and square down to give the position of the mortices in the head and bulls The bull on the side marked 4 feet 8 inches is at right-angles to the head, the distances between the ends of the bulls to be as marked in inches. When all is set out see that the diagonal measurement, 5 feet 10¾ inches, is as indicated in the plan. The angle-iron stay can be made from an old wheel tyre, about 1¾ inches wide. All the tines are 12 inches long, of 1 inch square steel, and slightly tapered to drive tight through the bulls.

When making the harrow, and before putting it together, every joint should be well coated with thick paint, preferably red lead and linseed oil, and the whole painted with three coats of coloured paint on completion.

Some Suggestions on Spray Management.

W. J. ALLEN and W. LE GAY BRERETON.

THE following article has been written with a view to helping orchardists to mix and apply sprays with the greatest possible expedition and economy. Much of the matter has already appeared at one time or another in the "Orchard Notes" that appear regularly in this *Gazette*, but there still exists in many orchards considerable room for improvement in spray management, and it is hoped that by gathering the recommendations relative to this important operation into one article some good to the fruit industry as a whole may result.

Waste of Material in Transport.

Perhaps the most obvious economic weakness is that which allows waste of spray in process of transport. Especially in orchards where hand pumps are used, it is no uncommon thing to see the spray mixture splashing out of the barrel when the outfit is full and on its journey from the mixing station to its position among the trees. Such splashing may easily run into a gallon or more of spray mixture on each trip, and at the end of a spray season will have accumulated into considerable loss.

Figures 1 and 2 show a type of lid for spray barrels that has given satisfactory service in one of the departmental orchards for many years. On the right of these illustrations is shown a 100-gallon vat fitted with the lid, and on the left the same type of lid in association with an ordinary 40-gallon barrel. The lid is so designed that the pump will be held securely when in action, and the whole of the lid can be quickly removed when it is necessary to repair the pump or clean the barrel. It is composed of two thicknesses (see *a*, Fig. 1) of 1-inch boards, with the grain running in opposite directions, screwed together, preferably with brass screws. It is made in two sections—one just wide enough to carry the pump, so that the remaining opening will take as wide a strainer as possible, thus facilitating rapid filling.

The section carrying the pump is provided with three iron straps of about 2 inches by $\frac{3}{8}$ inch flat iron, fastened by bolts on to the lid, as shown in the large vat. These straps project about 2 inches beyond the edge of the lid, the projecting portion being forked by cutting a $\frac{5}{8}$ inch slot in the centre to accommodate the $\frac{5}{8}$ inch bolts which clamp the lid down to the cask. The $\frac{5}{8}$ inch bolts are hinge-jointed on to a 2-inch iron strap, which is bolted into position through the staves of the cask (see *b*, Fig. 1), care being taken to see that they will not interfere with the knocking down of the hoops from time to time. The inside of the lid, where it comes in contact with the tops of the staves (which should be trimmed down so as to give a fairly true

surface in the case of an ordinary barrel), is provided with a ring of packing (see *c*, Fig. 2). Sacking makes a quite effective packing, provided it is tacked into position in such a manner that no frayed edges are exposed; bits of material from such edges eventually drop into the spray mixture and cause trouble in the pump or nozzles. The lid is screwed down tightly on to the packing by means of butterfly nuts. To remove the lid it is only necessary to loosen these sufficiently to slip the bolts out of the iron slots.

The pump section of the lid shown on the smaller barrel is not made on exactly the lines described, the only difference being, however, that, as it does not require to be removed very frequently, the wood can be carried out beyond the sides of the barrel and three holes bored in it to take the bolts with butterfly nuts. This difference in design means, of course, that the

Fig. 1.—On the left, a 40-gallon cask. On the right, a 100-gallon cask fitted with water-tight lid.

three butterfly nuts must be wholly unscrewed, not merely loosened. The 100-gallon vat can be used for carting spray mixture to the motor spray pump. When transferring the mixture it is convenient to have the whole of the lid off, and the whole lid is therefore fitted with the slotted iron plates for rapid removal.

The section of the lid which is removed for filling has along its under edge, where it comes in contact with the pump section of the lid, a wooden cleat about 1 inch thick and projecting about 1½ inches (see *d*, Fig. 2), so that when this section of the lid is placed in position the cleat's upper projecting side comes in contact with the lower side of the pump section (see Fig. 3). The edge of this section of the lid where it meets the edge of the other part of the lid is provided with packing (see *e*, Fig. 2), and the part

which comes in contact with the tops of the staves is packed in the same way as in the case of the larger half of the lid. The filling half of the lid carries one slotted iron strap on its upper side in the centre of its curved edge (see *f*, Fig. 2), this strap being provided with a corresponding hinged bolt with a butterfly nut, as described in connection with the pump section. When the filling section of the lid is screwed down the lid and packing will come in close contact with the staves of the barrel and the edge of the pump section. To remove it for filling only necessitates the loosening of one butterfly nut and the slipping forward of the hinged bolt out of the slot.

Fig. 2. On the left, the whole top of the lid removed for the cleaning of the cask, or repairs to pump. On the right, the smaller section of the lid is open to permit of filling.

Make Full Use of an Efficient Outfit.

Apart from waste of material during transport, there are two main headings under which lack of economy in spray practice is most common: first, an inefficient outfit (often this is due to want of capital rather than want of knowledge, and the remedy is beyond the scope of this paper); second, failure to take full advantage of an efficient power outfit.

Failure to take full advantage of an efficient outfit is sometimes due to running a power outfit at too low a pressure. The pressure maintained should be the highest possible, consistent with the capacity of the nozzle-men to spread the spray fluid delivered; a nozzle-man accustomed to a low pressure will take a little time to get used to a higher pressure and to take full advantage of it. A higher pressure can be more easily handled from a short spray rod than from a long one, but at Glen Innes Experiment Farm orchard, while a pressure of 180 to 200 lb. was formerly found a good general working pressure, the working pressure has lately been increased to

225 to 250 lb. Tests were conducted some years ago at the above orchard at 150 to 160 lb. and 180 to 200 lb. A measured quantity was of course put through more quickly at the higher pressure, but it was also found that the mixture went further. This test was repeated more than once with a lower consumption of material per tree on each occasion from the higher pressure, showing that the higher pressure not only saved time, but also effected a slight saving in material.

It is generally thought that the saving of material at the higher pressure is due to the material being broken up into a finer mist, but, even admitting this as a factor, there is no doubt the saving is largely due to the higher pressure giving the nozzle-man greater confidence in his work. The liquid hums out, the wood and foliage become wet more rapidly, and the operator moves his nozzle with corresponding rapidity, in the assurance that each part of his work is finished as he passes over it, whereas at a low pressure he will often double back over part of his work to make sure of it. This

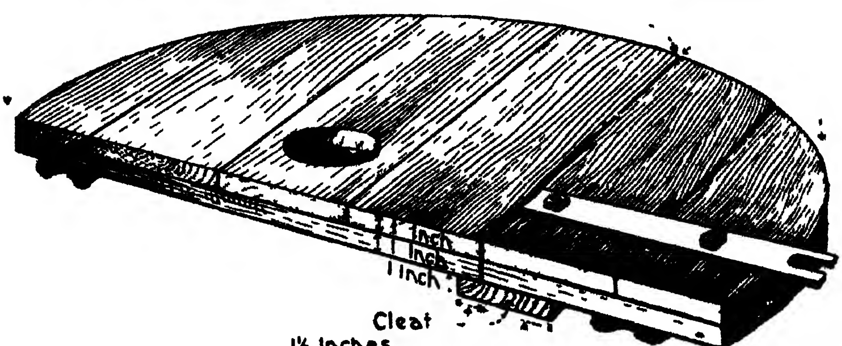


Fig. 3. A drawing, in section, of the lid.

will be brought home to one very quickly if, after working with a high pressure, he attempts to spray from a two-lead hand pump, under which conditions the pressure is often under 100 lb. The actual saving in time from a high pressure is, of course, to be expected, but there is a moral effect also on a good nozzle-man, the rapid hissing out of the spray exciting him to quick action and keeping him on the move.

At the same time it must be remembered that all the time the stop valve is open the spray is escaping, and just as quickly whether it is being directed where it is wanted or not, so that a lazy or poor nozzle-man may waste material very quickly at a high pressure. It is also necessary to cut off when passing from tree to tree. This is where a rapid cut-off is especially useful, but with a little practice a wheel valve can be operated without excessive waste. It will be noticed that a wheel valve only slightly opened (often less than a full turn) will allow sufficient liquid to pass through to keep the nozzles at full capacity; thus operated, the wheel valve is quickly turned on and as quickly turned off.

Time Lost in Refilling.

But perhaps failure to make full use of an efficient outfit more commonly occurs in another way; that is, too much time is spent in refilling and going backwards and forwards from the mixing station to the work. The aim of the spray man in charge of a power outfit should be to have it pumping spray on to the trees as far as practicable from the time it is taken out in the morning until it is brought in at night. It takes three men, a horse, and some form of transport to work two leads of hose from a hand pump. Two leads of hose from a power pump can be worked with two men and a horse. A power pump is generally turned out with its own transport; thus, one man from the old hand pump team is freed, and this freed hand can be profitably employed in mixing and carting the spray to the outfit. This will entail the use of another horse. Expediting the work in this way not only gives the orchardist a better opportunity of getting the spray on at the best period (which in the control of some diseases may mean the difference between success and failure), but also means economy in the time of the nozzle-men.

The Double Nozzle.

With hand pumps it is difficult, as a general rule, to obtain sufficient pressure to supply even two single nozzles, but many of the power pumps will maintain sufficient pressure for four nozzles. To use four leads of hose from one machine is not convenient; moreover, a team of four good even nozzle-men is often not available, and in order to take full advantage of the power available when applying lead arsenate and many of the fungicide sprays while the trees are in partial or full foliage two nozzles can be used on each lead of hose. The two nozzles can be easily attached to any spray rod by using a **Y** or **U** piece as shown at *g* in Fig. 2. The two nozzles on each rod can be set by varying their angle to throw their spray either towards or away from one another. Usually it will be found preferable to have at least the inside edges of the spray overlapping; if set at too wide an angle loss of material will occur. When a drenching spray is required, which necessitates holding the nozzle close to the affected part (as is necessary when spraying aphis to break up the clusters of the insect) the double nozzle should *not* be used, as it will be found wasteful. A single nozzle with a coarser jet will be found more suitable.

Use of Spray Guns

The possibilities presented by the use of spray guns were investigated by the Department in 1919,* but the gun used failed to give the requisite long-distance spray. Another gun has been tested recently, however, with quite satisfactory results in this respect, and a report will be published in the *Gazette* shortly.

* See "The Utility of the Spray Gun," (W. J. Allen), *Agricultural Gazette*, Dec., 1919.

Facilities for Mixing.

Sometimes it is difficult to keep the supply of spray material up to the motor outfit fast enough, and to overcome this it is necessary to have convenient means for quick mixing of the spray, filling the supply cart, and transferring the spray from the supply cart to the tank of the spray outfit. The first essential is a suitable water supply at a central mixing station. For large or scattered areas more than one mixing station should be provided to avoid long cartage, otherwise the tank of the spray outfit must be of proportionately greater capacity, which makes a heavier load to haul over the soft ground of the orchard. This drawback is more acute on steep hillsides or among large spreading trees that do not leave much passage-way. Often the pipes carrying the water to the required points are of only small capacity, and filling direct from them would be too slow. This difficulty can be obviated by having a cistern (of somewhat larger capacity than the tank of the spray outfit) connected with the water supply, so that the cistern will be filling through a ball tap while a load of spray is being taken out to the outfit. The cistern should be provided with a large outlet tap and hose or spouting, by which the supply cart or mixing casks can be quickly filled. The source of the water supply should be high enough to permit the cistern being elevated sufficiently to allow the water to run into the mixing casks (when such are necessary), which in turn should be on a staging high enough to allow their contents to run into the supply cart quickly through large taps and hose or spouting. Further reference will be made to this point later on, but it must be borne in mind that the object in view is to have everything arranged in regard to mixing so that the carter can carry out all the mixing *quickly and single-handed.*

It will be found if all the casks used in mixing sprays are marked on two opposite sides of the inside in graduations of 10 gallons, it will often save time and ensure greater accuracy than measuring the water in by, say, two or four gallon buckets. Time is lost in seeing that each bucket is full to the right mark, and there is a chance of the slight inaccuracy of each bucketful accumulating, whereas if the cask is marked as suggested and one wishes to make a spray up to, say, 42 gallons, all that is necessary is to measure or weigh in the material, fill the barrel up quickly by bucketing or by a hose, until the 40-gallon mark is reached, and then measure in the 2 gallons.

A convenient way to mark the casks is to set up a platform scale practically level, put on the cask and take the weight of it, then weigh in 10 gallons (100 lb.) of water, mark the level on two opposite sides by driving in a thin nail lightly at the water-level, add another 10 gallons and again mark, and so on till the top is reached. The water is then turned out, but it need not be wasted; it can be used for the next cask if more than one is to be marked, and the marks can be permanently made with a countersinking bit, so that the mark will be indicated by the centre of the hole. The marking is done on two opposite sides because often when in use the casks are not standing level, and a sufficiently correct measure can still be got by seeing the liquid is as much over one mark as it is under the other.

(To be continued.)

The Drying of Prunes, Currants, Sultanas, and Raisins.

W. J. ALLEN and S. A. HOGG

THE varieties of prunes chiefly grown in New South Wales are Prune d'Agen and Robe de Sergeant, but in some of the cooler districts Fellemberg and Silver prunes are grown to a limited extent. So far as the actual processing or drying is concerned the principle will be the same, with certain modifications which are governed by the texture of the fruit. For instance, the Silver prune has a very delicate texture and it only takes a very weak solution of caustic soda and boiling water to crack the skin; in fact the skin may be cracked by the use of boiling water alone, but this is not recommended, as the immersing process is a lengthy one unless a small proportion of caustic soda is used. The Fellemberg prune comes next in tenderness, followed by Robe de Sergeant and Prune d' Agen.

The Harvesting of the Prunes.

There are three intervals in the ripening of prunes. The first prunes that ripen do not as a rule contain the same amount of sugar as those that ripen in the second and third stages. As prunes that are deficient in sugar (and this, after all, is the main preserving factor) are subject to mould and also to an incrustation of sugar on the surface, which is sometimes mistaken by consumers for mould to the depreciation of their value, it is recommended that the prunes that ripen first be kept separate from the main crop and disposed of immediately they are ready for consumption. This first crop, or first ripening, invariably falls, if it is allowed to do so, and as a matter of practice it should be allowed to fall and should never be picked. A large percentage of the second crop or stage will also fall when sufficiently ripe, but as a rule the third crop or fruit of the third ripening stage will require to be picked, as they seem to adhere very tightly to the branches, even after they are fully ripe.

In all cases it is most important that the fruit should be allowed to attain its full percentage of sugar before drying, and all undeveloped fruit should be discarded. As the fruit is permitted to drop to the ground, precautions should be taken by the grower to see that the surface is loose and free from clods; in fact, the careful grower will take the precautions of raking around the base of the tree and outwards for a sufficient distance to catch any fruit that may drop from the spreading branches.

Dipping and Curing.

Having gathered the ripe fruit, a quantity of water is placed in a vessel of any convenient dimensions to a depth of not less than 18 inches. Caustic soda is then added to the water, and the whole brought to the boil. The percentage of caustic required for the desired purpose varies from 1 lb. of caustic soda (Greenbank's 90 per cent.) in 12 galls. water, to 1 lb. in 30 galls The water should be kept boiling. The prunes should now be placed in a basket, which is constructed of fine wire-netting, and known as a dipping basket. It is not advisable to use tins, as it is found that the lower fruit gets an excess of the solution, and cracks too much.

As it is impossible to state any fixed proportion for the solution, the correct strength can only be arrived at by testing. This should be done by placing a few typical prunes in the dipping basket, and immersing them for periods of from one to five seconds. It is preferable that the dipping should be as momentary as possible. If, therefore, it takes five seconds to bring about the desired amount of cracking, it would be better to add a little more caustic soda so as to reduce the period of immersion. If the solution is too strong it will split the fruit, which is most undesirable. If the solution is not strong enough it will have no effect on the exterior of the fruit, but if the solution is of the correct strength the fruit, after being exposed to the air for a few seconds, should show a network of minute cracks on the exterior.

Having arrived at the correct strength of the solution, it is preferable to immerse the fruit right to the bottom of the receptacle, then bring it to the surface and let it drain. The fruit should then be immediately placed on wooden trays or on the drying racks, upon which hessian or calico has been spread, and allowed to dry. Do not expose freshly-dipped fruit to the hot rays of the sun. If it is a very bright day the trays should be stacked, and, if the weather continues hot and bright, they should remain in stacks for three or four days before being exposed to the rays of the sun. The period of drying, of course, is influenced by the condition of the weather.

It will be found that the smaller fruit will have dried sufficiently before the larger. The trays should therefore be looked over and fruit sufficiently dry should be removed. On no account should the fruit be allowed to become hard. It should be removed from the trays when it feels tough but will not exude any juice when squeezed.

How it is Stored.

When the bulk of the fruit is sufficiently dry it may be stored to a depth of two or three feet on a cement floor, care being taken to turn the fruit from time to time with a shovel, say every fortnight, so that it may mature and even up in texture. It may remain in this heap for one month or two months, but the fruit should be carefully watched to see that fermentation does not set in or mould appear.

An alternative method is to place the prunes in wheat bags that have previously been dipped in boiling water and exposed to the sun. The bags having been aerated and dried may be filled and sewn up in a similar

manner to wheat, and may then be placed in stacks, but on no account to a greater depth than three bags; the pressure on the bottom one becomes excessive when four or five bags are placed on top.

With regard to turning the bags, it is really simpler than shovelling the loose prunes; the top bag is lifted off and the underside is turned uppermost on the floor; the middle bag is then lifted off and the bottom bag placed on the top of the bag first removed, and the middle bag is then placed on top of this. This operation should be carried out every fortnight or three weeks, according to the condition of the fruit.

The question is often raised, what is the correct time for the prunes to remain in the heap or in the bags? This can only really be arrived at by experience. It will be found that after a month or five weeks the prunes will become very slightly fermented—that is to say, one will just be able to smell the effects of the fermentation in the room or bags, as the case may be. There is nothing to be alarmed at in this, unless it is accompanied by mould, for the slight fermentation is really part of the maturing process, and is speedily controlled by the presence of sugar in the prunes. It actually adds to the flavour of the fruit, and gives it an extra aroma.

Re-dipping and Drying.

The next process is the re-dipping of the prunes in a saline bath prior to packing. To boiling water should be added sufficient salt to make its presence just detectable by the taste. Prunes that are in bags can be dipped bag and all, providing the dipping vessel is of sufficient dimensions, but they must be allowed to cool overnight before re-drying, grading, and packing. If the prunes have been stacked in a heap, they may be dipped in a dipping-basket. The time of immersion is again governed by the condition of the fruit; if it has become rather dry it requires from one to two seconds in the dipping basket, or from three to five seconds in the bags. Generally speaking, the second drying consists in exposing the fruit for a few hours, especially if it has been dipped in the dipping basket, but if it has been dipped in the bags a longer time must elapse before the fruit is sufficiently dry to pack. Prunes are packed in 28 lb. boxes, which should be lined with clean, white paper. The cases are 18 inches x 9 inches x 4¾ inches (inside measurements); they should be made of white pine, dressed on the outside.

It may be pointed out that prunes that are grown in the drier districts will keep better and remain free from sugaring for a much longer period in the district in which they are grown than in the city. It is, therefore, better if it can be arranged to hold the bulk and to supply the demand as required. There is really a double advantage in this; prunes invariably increase in price towards the end of the season, and if sufficient care is taken there should not be any appreciable loss; the other advantage is that a nice, fresh, bright article that appeals to the eye is presented to the consumer.

Drying Currants.

The bunches of currants should not be picked until the fruit is perfectly ripe and attains its maximum amount of sugar. This is not always very easily determined, but if it is noticed on inspection that the berries have become a very dark colour covered with bloom and that a few will fall when the bunches are shaken it may generally be taken that they are ready for picking. The bunches should then be cut, placed on trays, hessian, or drying racks, as the case may be, and dried in the shade.

Sultanas.

When one is unacquainted with the handling of sultanas he is very easily misled as to whether the fruit has developed sufficient sugar or otherwise. This may be determined by squeezing some of the juice into a vessel and testing it with a hydrometer, which should register somewhere in the vicinity of 14 degrees Baume, or higher. If this test cannot be carried out the only other test is to leave the fruit on the vines until it is considered they are sufficiently ripe. Of course there is always a risk with the latter method, as wet weather may come at any time and split the fruit. The more sugar this fruit contains the heavier the weight, and the better the dried article.

The fruit being picked, it should be immediately dipped in a hot solution of caustic soda and water of just sufficient strength to crack the outside of the fruit without splitting the skin, and with the minimum period of immersion. The water should be just off the boil, as a boiling solution has a tendency to toughen the berries. The fruit is placed on the drying racks or wooden trays immediately after dipping, and is dried in the shade.

Raisins.

The processing of raisins may be divided into two classes—pudding raisins and dessert raisins. The former are dipped, and the latter not dipped. In the production of lexias (dipped grapes) the fruit should be allowed to remain on the vine until it is perfectly ripe. The bunches should then be cut and immersed in a hot solution of caustic soda, carrying out the same instructions as those given above for sultanas, and the fruit may be similarly dried.

Dessert raisins, as mentioned, are not dipped. The bunches should be cut most carefully from the vine, great care being taken not to handle the berries or disturb the bloom. The fruit should be handled by the stalk, and generally laid on wooden trays. For the first week or so the fruit should not be exposed to the sun. At the end of a week the bunches should be turned over carefully. This may be done by placing an empty tray on top of the full one, and two men taking each one end invert the two trays. After remaining in this position for another week they may be exposed to the sun and finally dried.

Only the largest bunches and berries are used for this particular purpose, and although the process of drying is rather a lengthy one, taking from three weeks to a month, there is a fair demand for the product, at remunerative prices.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Wheat:—

Bomen	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	E. J. Allen, Gregra.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Canberra.. .	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Hughes Bros., Greenacres, Pullabooka, *via* Grenfell.
	H. M. Hall and Sons, Studbrook, Cunningar.
	W. W. Watson, Woodbine, Tichborne.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock
	T. M. Slattery, Mirrool.
	E. J. Allen, Gregra.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
	R. J. O. Berryman, Aviemore, Botfields
Canberra (ungraded) .	Meurant Bros., Cundumbul, Molong.
Clarendon .	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Coonamble.
Cleveland	W. Burns, Goongirwarrie, Carcoar.
College Purple	Hughston Bros., Hughstonia
Currawa	E. J. Allen, Gregra.
	Hughston Bros., Hughstonia.
Federation	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	W. W. Watson, Woodbine, Tichborne.
	R. McCrone and Son., Bungambil, Mirrool.
	Hobson Bros., Glenlea, Cunningar.
	T. M. Slattery, Mirrool.
Firbank	T. M. Slattery, Mirrool.
Florence . .	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Glen Innes.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley .	Manager, Experiment Farm, Temora.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	E. J. Allen, Gregra.
Hamel	Manager, Experiment Farm, Temora.
Hard Federation .. .	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	W. W. Watson, Woodbine, Tichborne.
	T. R. Sharp, Bona Vista, Forbes
Improved Steinwedel	W. W. Watson, Woodbine, Tichborne.
Major	Hughston Bros., Hughstonia
Marshall's No. 3	Manager, Wagga Experiment Farm, Bomen.
	Hobson Bros., Glenlea, Cunningar.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.

***Wheat*—*continued*.**	
Penny	W. W. Watson, Woodbine, Tichborne.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Rymer	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock
Sunset	Manager, Experiment Farm, Coonamble.
Thew	H. M. Hall and Sons, Studbrook, Cunningar.
Warden	Manager, Experiment Farm, Cowra.
	Manager, Wagga Experiment Farm, Bomen.
	W. W. Watson, Woodbine, Tichborne
	H. M. Hall and Sons, Studbrook, Cunningar,
	Cornish Bros., Scoble, Whylandra, *via* Dubbo
	Hughston Bros , Hughstonia.
Yandilla King	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	H M. Hall and Sons, Studbrook, Cunningar
	Hobson Bros., Glenlea, Cunningar.
	Hughston Bros , Hughstonia.
***Oats*:—**	
Algerian	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora
	Manager, Experiment Farm, Cowra
	Manager, Experiment Farm, Glen Innes.
	W. Burns, Goongirwarrie, Carcoar.
Guyra	Manager, Experiment Farm, Glen Innes
Lachlan	Manager, Experiment Farm, Cowra
	W. W. Watson, Woodbine, Tichborne
Mulga	Manager, Experiment Farm, Glen Innes
	Manager, Experiment Farm, Cowra
Sunrise	Manager, Experiment Farm, Coonamble
	Manager, Experiment Farm, Temora
	Manager, Experiment Farm, Cowra
	W W. Watson, Woodbine, Tichborne

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed

A Big Venture.

TWENTY bankers' state associations, and a large number of individual banks, are awarding 10,000 dollars this year, exclusive of county prizes, to the boys and girls doing outstanding club work in the United States. In addition, it is estimated that approximately 2,000,000 dollars has been loaned to worthy boys and girls for the purchase of livestock and seed, all of which will be paid back with interest this fall when the youngsters have completed their projects under the direction of the agents of the agricultural colleges.—G. L NOBLE, in *The Banker Farmer.*

THE results obtained with Kikuyu grass (*Pennisetum clandestinum*) have exceeded expectations. Being a most palatable grass and resisting dry conditions well, it gives promise of being one of the most valuable summer grasses that has been introduced into this State up to the present time. Grazing trials with Kikuyu have been carried out on farmers' grass plots and at experiment farms, and very satisfactory results have been achieved. —J. N. WHITTET, Agrostologist.

Poultry Notes

FEBRUARY.

JAMES HADLINGTON, Poultry Expert

EXPERIENCED poultry farmers who read these notes might sometimes question the necessity for certain reminders and for some other information given on simple matters. But such men must not overlook the fact that there are hundreds of persons interested who do not know. Some are starting poultry farms, and others are keeping poultry on a smaller scale in the suburbs, while the way-back farmer must also be considered. Each class seeks information from the Department from time to time. One new arrival in the country, for instance, recently inquired, "what are the seasons affecting the different phases of poultry culture, what months comprise the moulting period and the hatching season, and when are hens in the flush of laying in this country?" A local poultry farmer asks, "Should my first-year hens be falling into moult now, and if they do so, are they likely to prove profitable in their second year as layers?"

The first question shows the necessity for constant reminders about seasonable work. The second is a question that must be uppermost in the minds of many established poultry farmers, particularly in view of the high cost of feeding that has prevailed recently. The question is raised, too, whether it pays to keep second-year hens. These questions are legitimate, and not to be disposed of without explanation.

In connection with keeping hens for two laying seasons, we have to consider the alternative—that is, keeping hens for one year's laying only. Some few breeders have attempted this, but poultry farmers in general usually find it hard enough to raise sufficient pullets to replace half their entire stock in one year without attempting to replace the whole. Let us consider what the replacement of the whole flock annually means. We can best illustrate it by supposing the farmer has a stock of 800 layers. Under the usual practice of replacing 400 each year, he would require to hatch at least 1,000 chickens because, as has often been explained, 400 pullets is the most one can expect from 1,000 chickens, after making allowance for half cockerels and a 20 per cent loss in rearing. The farmer who essays to replace his 800 hens each year, therefore, must annually hatch 2,000 chickens and successfully rear 1,600. Indeed, to make up the losses in his adult stock, say 8 to 10 per cent., he must actually rear a few more. Such a task might appear simple to the person who has not attempted to rear such large numbers, but to those who know what is involved it presents different features. The fact is, the poultry farmer has his limitations in rearing chickens, as regards both his own capacity and that of his equipment.

There is no question that an overwhelming number of poultry farmers will back up the idea that, taken by and large, it pays them to keep hens to the end of their second-year laying. It is, then, a matter of experience, and it is also borne out by the results of competitions. In fact, if the practice of keeping hens for two seasons' laying was not sound, there is scarcely a poultry farmer in the State who would not be bankrupt.

Again, if the second-year hens did not pay, all the farms carrying half first-year and half second-year hens would be only partially stocked with profit-producing hens, and instead of a farmer living on 600 or 800 hens, his

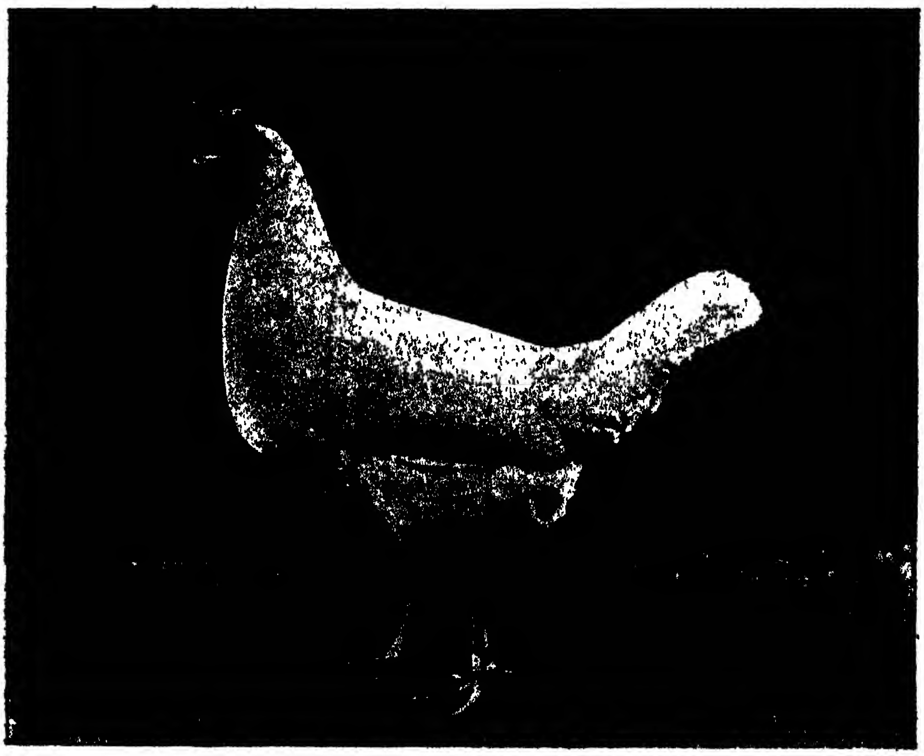


Fig. 1.—Hen in full bloom, and laying.

Note the head points, particularly the expansion and freshness of the comb.

earning power would be but half that number. It is, of course, obvious quite apart from figures that can be produced that it does pay to keep second-year hens.

I am afraid that a misunderstanding of this question and of culling generally has been responsible for a depletion of the stock on some farms to a non-supporting point. The subject was discussed in these notes in October last under the heading "Culling too Early." The point there made will have been verified, because it has been a fairly general experience that egg-production has not fallen off to the extent that many were anticipating at that time. It can, therefore, be stated that it will pay to keep good hens in their second year of laying.

A Critical Period.

This is the time of the year when good judgment and experience in handling flocks will contribute very materially to success in running a poultry farm. The objective should be to cull out the prospective unprofitable units in the flock without disposing of those that are likely to be profitable units perhaps for months to come.

In this connection it might be pointed out that many poultry farmers by faulty management check the laying of their hens, and thereby induce an

Fig. 2.—Hen temporarily off laying.

Note the head points with comb drying up, and also some little loss of feather on neck and breast. This does not denote a full natural moult. A hen in this condition might come on to lay again, and prove a "late moulter," in which case she would be a most profitable bird to retain.

early moult. The early moulter is most likely to go through a second moult, and thus laying will be retarded till the end of the winter. The hens that moult late are generally the high producers.

Culling.

"Yes, that is the idea"—one can almost hear it from readers of these notes; "but what we want to know is how to cull. What about some system that will enable even the novice to cull?" The mind of the beginner at once reverts to some advertised system of "picking the layers," and he

imagines that if he could only pick the layers from the non-layers the thing would be simple. As has already been pointed out in these notes, it is a very simple matter to do this either by an anatomical test, such as the closing and rigidity of the pelvic bones situate on either side of the cloaca, or by observation of the condition and colour of the comb, the sprightliness or otherwise of the hens, &c These signs will enable the person of average intelligence to pick out the hen that is not laying from the one that is, and the merest tyro in poultry matters should be able to do this. But what is not simple is to bring the average beginner to a realisation of the fact that such methods of selection are only the A B C of the subject, and that they do not take the place of the judgment that has to be formed on the many other factors that must enter into the calculation. If poultry-farmers were to spend on the study of their flocks a tithe of the time and thought (not to mention money) that they give to the pursuit of short-cut "systems" they would be much more proficient and successful in their business.

The mere determination whether or not a hen is actually laying by no means ends the matter. The question then arises, what class of hen she is. Is she a prospective good layer, has she been so, or is she a weedy specimen, with small eyes, and altogether lacking in character? It must also be asked has she started to moult, and if so, is she moulting heavily, or is she moulting so slowly that she is likely to resume laying after a short spell? (See Fig. 2.) Again, is the hen actually in a natural moult, or is the loss of feathers due to other causes, such as feather-eating, or is the bare patch on the back the result of being in the breeding-pen? Many hens that look dilapidated in feather may be so as a result of such causes, and although perhaps temporarily off laying, may resume again, and prove to be what is known as "late moulters," in which case they may be most profitable hens to keep from the fact that they will perhaps lay through the next two or three months, when eggs are high in price.

These are the factors that enter into the consideration whether a hen should be disposed of or not. After all there should not be a large proportion of hens rising their second year that should require culling. In a flock of hens of good physique that have been well reared in the first place, and subsequently well managed, there should not be a large proportion of unprofitable units to cull, probably not more than 10 per cent. that would not at least return some profit in their second season of laying, even under present conditions.

Much the same remarks apply to pullets just maturing. To apply pelvic bone measurements or tests to them leads to throwing hundreds of good pullets out. There should not be more than 5 to 8 per cent. to cull, providing they are well grown pullets.

THE burdens of labour and loneliness bear most heavily upon the women of the farm, but if the farm wife and mother performs her duty faithfully and well she is rendering a service to agriculture and humanity greater than any other class of our citizenship.—THEODORE ROOSEVELT.

February Work in the Apiary.

W. A. GOODACRE, Senior Apiary Instructor.

DURING good seasons it is generally found that a large quantity of honey is extracted at this period of the year. This season, however, the prospects are not bright, except for those bee-farmers who are expecting an autumn flow of honey; in these cases the progressive conditions may be in evidence towards the end of the month.

Good general rain is needed previous to the flowering of the flora to assure a good secretion of nectar. Where conditions have been adverse for some considerable time, the prospects offering for the autumn should give much encouragement to bee-farmers. Bees will withstand hard times through a season, but they require some stimulating conditions during the autumn to give the colonies a chance to prepare for the hardships of winter. Moreover, apart from an improvement in the conditions and prospects of the colonies, apiarists are looking forward to obtaining some surplus from the hives.

The bee-farmer who knows his locality will have a good idea regarding the time the trees will commence to flower, and much can be done to prepare the colonies so that the best results may be obtained. It is a good plan usually to give stimulating food for a few weeks previous to the flowering of the flora, so as to give the bees a start. It is better to start the bees artifically and to let them come into good natural conditions in the right spirit, rather than to allow them to wait and make their own start after the flow comes on.

Stimulating the Colonies.

Where a large number of colonies are kept it is a difficult matter to put food in each hive daily, and it is the usual practice therefore in large apiaries to give about 6 lb. of sugar syrup, or honey slightly thinned down with water, in one quantity, that being about sufficient for a week's supply. The bees will distribute the new supply of stores about the brood nest, and use it freely for brood-raising.

In smaller apiaries the practice of giving about a pint of food daily is very effective. The supply mentioned is for a fairly populous colony; if colonies are weak in population less may be given.

This "feeding on spec" is not often necessary, and many bee-farmers do not carry a stock of special feeders for their hives. Where no feeders are on hand, the honey or syrup can be poured into empty combs, and after draining for a while the combs can be placed in the hives. Do the feeding work late in the afternoon to prevent risk of robbing. If honey is to be fed to the bees, make sure it comes from a source free from disease.

Diseases in Bees.

During the past two seasons several cases of "sac-brood" have been brought under the notice of the Department. Compared with the destructiveness of foul-brood, sac-brood is not considered very serious to the industry generally; nevertheless there are times when a colony is seriously weakened by it, and that at a period when the population of the hive is of much importance to the apiarist. The first impression of a comb infected with sac-brood suggests American foul-brood (*Bacillus* larvae). The majority of the larvae die after being sealed, and the cappings on the cells are discoloured, sunken, and perforated; so far these symptoms are typical of American foul-brood. Sac-brood does not, however, respond to other tests which are applied for foul-brood. Larvae dead from sac-brood are easily removed from the cells, and in the majority of cases can be removed intact with the aid of a pair of tweezers; there is no pronounced ropiness in the diseased matter, and practically no odour. The colour of the infected larvae varies from a light yellow in its early stages to brown. In a good number of cells in the samples we examined, the colour of the diseased larvae had turned quite dark, and the material was of a pasty nature. It will be seen that these latter symptoms show distinct differences from American foul-brood.

The bees during progressive times are able to clean up combs infected with sac-brood, and combs stored for a period of one month are considered to be free from infection. The best method of treatment is to Italianise the colonies with young queens from a vigorous strain.

Incubation of Queen Cells.

The Poultry Expert mentioned some time ago in this journal that crippled chicks often issue from eggs which have been incorrectly incubated. In the incubation of queen cells the apiarist is likely to have somewhat similar trouble if care is not taken. The queen cells are incubated in the hive by the bees keeping up the temperature required, but in the course of a bee-farmer's work the hives have to be manipulated, and the queen cells removed. Care should be taken to see that the cells are not exposed for any length of time, especially below a temperature of 80 degrees, or the queens will either die in the cells, or will probably be crippled. Ripe cells can be kept out of the hive longer than those of lesser development.

Honey as a Food.

Honey is practically the only food that is immediately absorbed into the system and that leaves no residue; in the digestion there is no exertion on the part of the stomach. Many medical men say we eat too much sugar, and if a larger portion of our sugar diet was composed of honey the health of the community in general would be improved. Since honey is so easy to assimilate in the stomach, and contains valuable food matter, it is a most desirable sweet for children.

Honey is a food in which practically none of the organisms which produce the known serious diseases of the human system can exist. Honey will keep good for years, and is not subject to infection or deterioration when given ordinary care. This is more than can be said of many other foods.

Orchard Notes.

February.

W. J. ALLEN and W. LE GAY BRERETON

In inland districts where the rainfall is only limited and irrigation is not available, it is a good plan, if time will permit, to plough parts of the orchard as they are cleared of fruit, so that the land may be in condition to absorb any rains that fall, and as far as possible to store them for the following growing season. Under western conditions soil moisture is the main limiting factor with orchards as with other crops. It may be added also that under such conditions our soils are lacking in humus, and unfortunately the growth of cover crops for ploughing under is not a suitable method of supplying this want, because in normal seasons there is not sufficient moisture to supply both the fruit and the cover crop. Moreover, even where the rainfall is ample in normal seasons, cover crops should only be grown with discretion.

There are many parts of the State in which an ample rainfall is normally enjoyed, but which this season have experienced an extremely dry time, and as there is no certainty of good autumn falls of rain, or that next season will not also be dry, it would be wiser this season to plough as early as possible in the autumn and not to sow a cover crop until there has been a spell of heavy rain and the subsoil is again soaked. Of course, in some of our tableland districts there have already been rains that assure this, and in such cases the system of green manuring can go on without interruption, as also where ample water for irrigation is available.

It may not be out of place to reiterate here that where cover crops are sown they should be ploughed under by about mid-winter.

Green manuring is practised primarily to supply humus to the soil, and, as under many conditions it can only be carried out intermittently, every effort should be made to cart on to the orchard land any humus-supplying matter that is readily available. A successful grower on a light, sandy soil on the Hawkesbury River is so convinced of the necessity of maintaining the humus content in the soil that he roughly chaffs all the stalks from his maize crops and ploughs them under among his trees. His action in this matter suggests the possibilities of growing a crop for the purpose, preferably one which will make some independent return but which will leave a bulky residue that can be applied to the orchard soil. Of course, such a practice could only be considered under conditions that generally forbid the raising of green manure crops among the trees. As it happens this is often the case in our inland districts where land values are not so high, and the fruitgrower generally has more spare land than in the more closely settled districts on the coast and tablelands.

Pests.

The present month is generally about the time that red scale of citrus trees is breeding, and it should be dealt with before the protective covering of the young scale develops sufficiently to render the pest immune to treatment. Resin soda wash (a leaflet on which may be obtained on application) is one of the most effective and safest sprays to use. If white wax is the only scale present, then washing soda solution (1½ lb. to 4 gallons of water) is sufficient. Generally white wax commences to hatch out earlier than the red scale, and must be dealt with before the insects of the earliest hatching are as big as wax match heads.

Fumigation still proves to be the more efficient method of dealing with citrus scale. One decided advantage that it has over spraying is that it is effective on young scale at a later stage than are sprays, which means that fumigation can be delayed until later than spraying, with a better chance of all the eggs of later scales having been hatched. In seasons like the present this delay gives a further chance of a good soaking rain falling, and in many districts at the present time it would be risky either to fumigate or to spray, as the trees are suffering from lack of moisture.

The apple and pear grower is sometimes tempted during the busy part of the picking season to neglect the regular collecting and destroying of moth-infected fruit. Such neglect only means more trouble and loss later—if not this season then the next—and it must be emphasised that vigorous precautions must be kept up throughout the season if the pest is to be kept satisfactorily under control.

Where returned cases are in use, care should be taken that infection is not brought in from outside sources. These remarks, both as to the regular collection and destruction of infected fruit and the care of returned cases, apply just as forcibly to the control of fruit-fly.

Harvesting.

Last month instruction was given as to the picking and marketing of peaches. Such notes also apply to other stone fruits for the fresh fruit market. Hints on the picking of pears and apples have appeared in these notes in former years, but perhaps it will not be out of place to repeat them.

Some of the early varieties of apples are harvested purely as cookers, and these can be picked as soon as they are up to size, provided the demand is good. When picking for export, especially for early shipments, the grower is necessarily influenced to some extent by the sailing of the boats, though fortunately both apples and pears will ripen and develop their full flavour and typical texture after they are picked—in fact, the majority of pears will not ripen satisfactorily on the trees. There is, however, a certain stage which both apples and pears should reach before they are picked, and there are several indications by which this stage can be judged. The browning of the pips, for instance, cannot be relied upon by itself, but the condition of the flesh must also be taken into consideration. The flesh when cut or bitten

should have lost its woody texture, and show some juiciness. When tasted there should be an indication of the sweetness and flavour (though of course, not fully developed) characteristic of the variety when ripe. Coloured varieties should hang, if possible, till their colour develops sufficiently.

But the indication which has most influence in forming a decision as to when to pick, is the readiness with which the stalk parts at its union with the spur. Naturally, if one delays picking after this condition prevails, there is great risk of heavy loss from wind. Ability to judge the condition when to pick is very easy to acquire, and one soon gets familiar with the varieties one is handling. But caution must be exercised in not trying to generalise too much. For instance, Williams' pears may be picked very green if the price and market warrant. Packham's Triumph, on the other hand, must be allowed to hang until well matured or it will not ripen well after picking, and will show a change from the green colour of the skin some time before it is fit to pick.

It is not wise in some districts to wait for colour in such varieties of apples as Gravenstein and McIntosh Red, as they fall before developing it. With such varieties, if one wishes to leave them as long as possible to colour, the trees should be mulched with straw or dried grass and the fallen fruit picked up daily. Delicious must be allowed to hang till well matured on the tree, or its texture will remain woody and unpalatable. This apple hangs well, and the early specimens can often be allowed to hang till the later ones on the same tree are fit to pick, though with most varieties of apples and pears it is necessary to go over the trees two or three times.

Manuring.

In localities where the soil is sufficiently moist citrus trees can receive their summer dressing of manure this month, but if the soil is very dry it would be better to withold this dressing.

While the soil is dry it is a good opportunity to cart on any soil for re-soiling or stable manure or other matter to supply humus.

Re-working.

If the sap is running freely it is a good time to bud any trees that have been previously cut down in preparation for this work. When securing buds be sure to select them from trees that have proved to be constant croppers of a good type of their variety.

Increased attention is being given by farmers to peanuts as a crop as a result of departmental experiments on farmers' land on the North Coast. Excellent results have been obtained on rather poor land in the Richmond River district, and experiments with this crop are being extended on the coast and on the Murrumbidgee Irrigation Area.—H. Wenholz, Special Agricultural Instructor.

Root Development of the Apple as Affected by Cultural Methods.

Notable variations were observed in the size and weight of the root and top of 8-year old Grimes apple-trees grown at Laurel, Indiana, U.S.A., under three different systems of soil management—namely, tillage, straw mulch, and sod. (*Amer. Soc. Hort. Sci. Proc.* 18, 1921).

Exercising all possible care to secure the entire root system, eight trees were removed from each plot in the summer of 1921. The average weights were as follows:—Tillage, entire tree, 303·6 lb., top 230·4, root 73·2; straw mulch, entire tree, 250·8 lb., top 186·4, root 64·4; sod, entire tree, 14·2 lb., top 10, and root 4·2 lb. The average gains in circumference of trunk for the three lots of trees for the period 1915–1920 were 5·44 cm. (2·1 in.) for tillage, 5·08 cm. for straw mulch, and 1·15 cm. for sod. The total yield in fruit for the three lots in 1920 was 63 lb. for tillage, 190·25 lb. for straw mulch, and none for sod. The greater weight of the tilled trees as compared with the straw mulch trees is believed possibly to be due to the fact that the latter have borne much more fruit, thus limiting vegetative development.

The soil beneath the tilled trees was found to be in much better physical condition at a greater depth than in the other plots, although analysis failed to show any higher nitrogen or organic matter content in the subsoil. The total nitrogen content of the surface layer of soil was lower in the tilled plot than in either of the others, but this variation had caused no apparent decrease in vegetative development of the trees. The main root systems of the tilled trees penetrated to a greater depth than did those of either of the other treatments. It was found that beneath the straw mulch the root system was very shallow, some roots lying on the surface of the soil, with the majority (75 to 80 per cent.) present in the upper foot of soil. The root system of sod trees had made but meagre development.

The Economic Significance of Poultry-farming.

It is gratifying to know that, despite the continued very high cost of feeding, the poultry industry is making considerable progress. The production of eggs and table poultry on modern lines is very largely replacing the side-line production that was at one time the main source of supply. In other words, poultry-farming is becoming a specialised pursuit which involves the purchase of practically all the foodstuffs (except succulent green), and thus poultry-farmers become very large purchasers of wheat, maize, &c., and also of mill offal, as well as other necessary subsidiary lines such as meat meal, bone meal, &c. The total value of poultry foods consumed cannot be less than £1,500,000 per annum. Thus it will be seen what a valuable local customer the poultry-farmer has become to our other primary producers, such as growers of wheat, maize, &c., and to flour millers, &c. As far as the latter are concerned, it is safe to say that but for the very large consumption of pollard and bran by poultry, those commodities would be worth little less than half their present value, and as a result flour would most certainly be higher in price.—James Hadlington.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
Yanco A. Society (Leeton)	W. M. Evans ...	Feb. 13, 14
Shoalhaven A. and H. Association	H. Rauch... ...	„ 14, 15
Tilba A. P. and H. Society	R. G. Swan ...	„ 14, 15
Dapto A. and H. Society	E. G. Coghlan ...	„ 16, 17
Campbelltown A. Society	J. T. Deane ...	„ 16, 17
Guyra P. A. and H. Association	P. N. Stevenson...	„ 20, 21, 22
Pambula A. H. and P. Society	K. Longhurst ...	„ 21, 22
Milton A. and H. Association	R. F. Cork ...	„ 21, 22
Nepean District A. H. and I. Society (Penrith) ...	C. H. Fulton ...	„ 22, 23, 24
Wyong District A. Association..	G. L. Garnsey ..	„ 23, 24
Kangaroo Valley A. and H. Association	L. W. Vance ...	„ 23, 24
Hannamvale Branch Agricultural Bureau	W. H. Buttsworth	„ 23, 24
Newcastle A. H. and I. Association	E. J. Dann ...	„ 27 to Mar. 3
Southern New England P. and A. Association (Uralla)	C. T. Griffin ...	„ 27 to Mar. 1
Dorrigo and Guy Fawkes A. Association	A. C. Newman ...	„ 28 „ 1
Robertson A. and H. Society	E. S. Martin ...	„ 28 „ 1
Alstonville Agricultural Society	W. J. Dunnet ...	„ 28 „ 1
Moruya A. and P. Society	H. P. Jeffery ...	„ 28 „ 1
Griffith A. Society	M. E. Sellin ...	„ 28 „ 1
Braidwood P. A. and H. Association	R. L. Irwin ...	„ 28 „ 1
Oberon A. H. and P. Association	C. S. Chudleigh ...	Mar. 1, 2
Crookwell A., P., and H. Society	C. H. Levy ...	„ 1, 2
Luddenham A. and H. Society	L. W. Eaton ...	„ 2, 3
Fairfield Agricultural Bureau	H. P. Godfrey ...	„ 2, 3
Central New England P. & A. Assoc. (Glen Innes) ..	Geo. A. Priest ...	„ 6, 7, 8
Orange A. and P. Association	G. L. Williams ...	„ 6, 7, 8
Manning River A. and H Association (Taree) ...	R. Plummer ...	„ 6, 7, 8
Yass P. and A. Association	E. A. Hickey ...	„ 7, 8
Tumut A. and P. Association	T. E. Wilkinson ...	„ 7, 8
Bangalow A. and I. Society	W. H. Reading ...	„ 7, 8
Hunter River A. and H. Assoc. (West Maitland) ...	J. S. Hoskins ...	„ 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	„ 8, 9, 10
Blacktown A. Society	J. McMurtrie ...	„ 9, 10
Rydal A. H. and P. Association	S. B. Prior ...	„ 10
Coramba P. A. and H. Association	H. E. Hindmarsh	„ 13, 14
Mudgee A. P. H. and I. Association	S. H. Somerville ..	„ 13, 14, 15
Quirindi P., A., and H. Association	Geo. Curtis ...	„ 13, 14, 15
Cobargo A. P. and H. Society	T. Kennelly ...	„ 14, 15
Cooma P. and A. Association	C. J. Walmsley ...	„ 14, 15
Macleay A. H. and I. Association (Kempsey) ...	R. T. Tarrant ...	„ 14, 15, 16
Cumnock P. A. and H. Association	K. J. Abernethy	„ 16
Eden Exhibition Society	H. P. Wellings ...	„ 16, 17
Camden A. H. and I. Society	G. V. Sidman ...	„ 16, 17
Batlow A. Society	C. S. Gregory ...	„ 20, 21
Tamworth P. and A. Association	F. G. Callaghan ...	„ 20, 21, 22
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	„ 21, 22
Walcha P. and A. Association	A. D. Murchie ...	„ 21, 22
Bellinger River A. Association (Bellingen)	J. F. Reynolds ...	„ 21, 22, 23
Gloucester A. H. and P. Society	F. S. Chester ...	Cancelled.
Royal Agricultural Society of N.S.W.	H. M. Somer ...	Mar. 28 to Ap. 4
Urbenville A. P. H. and I. Society	C. C. Wood ...	Apr. 4, 5
Lidcombe Branch Agricultural Bureau	J. M. Macey ...	„ 7
Richmond River A. H. and P. Society (Casino) ...	P. M. Swanson ...	„ 10, 11, 12
Bulladelah Agricultural Bureau	F. Coleman ...	„ 12, 13

AGRICULTURAL SOCIETIES' SHOWS—*continued.*

1923.

Society.	Secretary.	Date.
Moree P. and A. Society	C. G. Hobbes	Apr. 17, 18, 19
Upper Manning A. and H. Association (Wingham)...	D. Stewart	" 18, 19
Clarence P. and A. Society (Grafton)	L. C. Lawson	" 18 to 21
Ulmarra P. and A. Society	R. N. Shaw	" 25, 26
Dungog A. and H. Association...	W. H. Green	" 25, 26, 27
Maclean P. and A. Society	R. D. Munro	May 2, 3
Narrabri P. A. and H. Association	E. J. Kimmorley...	" 2, 3
Hawkesbury District Association (Windsor)	H. S. Johnston ...	" 3, 4, 5
Junee P. A. and I. Association	T. C. Humphrys.	Aug. 21, 22
Murrumbidgee P. and A. Association (Wagga)	F. H. Croaker ...	" 28, 29, 30
Culcairn P., A., H., and I. Society	L. H. M. Newton.	Sept 4, 5
Holbrook P. A. and H. Society...	J. S. Stewart ...	" 18, 19
Ganmain A. and P. Association	T. S. Henderson...	" 18, 19
Northern A. Association (Singleton)	J. T. McMahon ...	" 20, 21, 22
Narandera P. and A. Association	W. H. Canton ...	Oct. 3, 4

Compound Causes of Ill-health in Plants.

As in the case of animals and human beings, poor condition in a plant is often not traceable to a single cause—there are frequently contributory or predisposing influences. This was illustrated in a specimen of a minute insect that was recently forwarded to the Department by a correspondent who reported that it has been causing serious damage to pumpkins, melons, grammas, and cucumbers in the past two seasons in the Kalang, via Bellingen, district. The insect appeared to attach itself to the under part of the plants, and when disturbed fell off as if dead. It appeared to ringbark the vines. Arsenate of lead had been tried without result. Vines in full bearing, with the crop almost dead ripe, died off in a few days.

Mr. W. W. Froggatt, Government Entomologist, reported the insect to be the Northern plant bug (*Megymenum insulare*), which damages the plants it attacks by burying its beak in the tissue and sucking up the sap. The insect was difficult to deal with on pumpkins, but could be destroyed by spraying under the plant with any oil emulsion—it was useless to apply surface poisons. He did not think, however, that all of the damage evidenced by the pumpkin leaves submitted would be caused by plant-eating bugs unless they were very numerous indeed.

The foliage appeared to have been attacked by some fungus disease, and the specimens were therefore forwarded to the Biological Branch for examination, with the result that Dr. G. P. Darnell-Smith, Biologist, subsequently reported as follows:—"A fungus, *Alternaria* sp., is present in some of the spotted areas. Many specimens of *Alternaria* live on dead vegetable matter, but under conditions favourable to their development may become parasitic. Such conditions may be brought about by an unfavourable state of the soil or adverse weather, either of which reduces the vitality of the plant. Bordeaux mixture is recommended for the control of the fungus."

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Agricultural Gazette of New South Wales.

Field Wheat and Fallowing Competition.

EUGOWRA P., A., AND H. ASSOCIATION.

W. D. KERLE, Senior Agricultural Instructor.*

EUGOWRA, situated midway between Canowindra and Forbes, and just recently connected with the former by rail, is the centre of one of the best wheat districts in the State. It has an annual rainfall of about 22 inches and it is some 900 feet above sea level. The soil for the most part is volcanic, derived mainly from granite and felsites, particularly the former, with a fair proportion of sandstone, and bordering the Lachlan River and Mandagery Creek fertile alluvial flats, where lucerne grows to perfection. The red volcanic soil, deep, and with a subsoil retentive of moisture, is typical of the best wheat-growing country.

A total of fourteen entries (located within 15 miles of the township) were received for the first 50-acre wheat-growing competition conducted by the Association. Four entries were withdrawn at the last moment. Had the prospects of a decent season been brighter the entries would have been doubled. For the fallowing competition six entries were received. Judging took place on 8th and 9th November, 1922.

The Season.

In common with the rest of the central-western district, the rainfall for the season 1922 was much below the average, only 14·95 inches being recorded, as against 24·76 inches for 1921 and 24·03 inches for 1920. An average of 7·36 inches of rain fell on the growing crop, while the fallows received approximately 12½ inches. In the first two months of the growing period the rainfall was light, but July gave the only decent fall during the growth of the crop. It was followed by three months of comparatively dry weather, particularly in September and October, when most required. The two crops grown on stubble ground went off in the last few weeks of growth, having no such reserve of moisture on which to draw as had the fallowed ground. Two crops on black alluvial soil showed signs of wilting and burning, as is customary in soil of this nature when drought conditions prevail.

The Results

The awards and crop details are given in the accompanying table. The Association awarded prizes of £10, £4, and £2 to the first three competitors.

Mr. G. W. Armstrong.—The crop which secured first place was a very excellent one of Canberra; true to type, well stooled, evenly headed, and the ears particularly well filled. It was estimated to yield 33 bushels, and

* With the permission of the Minister for Agriculture, the services of Mr. Kerle were made available to the Association in the capacity of judge.

DETAILS of Awards in the Eugowra Field Wheat Competition.

Name of Competitor.	Variety.	Time of Seeding.	Crop Sown on—	No. of Crops on Land.	Seed per Acre	Superphosphate per Acre.	Rainfall. On Fallow.	Rainfall. On Growing Crop.	Estimated Yield.*	Trueness to Type, Max. 20.	Freedom from Disease, Max. 20.	Evenness, Max 20.	Cleanliness. †	Condition and Appearance.‡	Total.
					lb.	lb.	pts.	pts.	bus	pts.	pts.	pts.	pts.	pts.	pts.
G. W. Armstrong	Canberra	May, 3rd week	August fallow	12	50	56	1,350	780	33	19	18	19	24	26	139
N. H. Pengilly ...	Canberra and Red Russian.	,, 4th week ..	June ,,	10	45	45	1,522	808	29	18	20	18	28	24	137
H. F. Sweeney .	Federation	April, 1st week..	Sept. ,,	6	50	40	1,222	801	27	18	16	18	28	26	133
W. C. Childs ...	Canberra and Imp. Steinwedel.	20th May	August ,,	6	60	56	1,324	716	29	18	18	18	21	25	129
W. J. Wright ...	Imp. Steinwedel ...	May, 1st week...	Sept. ,,	9	60		1,230	654	25	18	16	19	28	22	126
H. W. Vincent...	Canberra	16th May ..	Wheat stubble	3	50	45	...	839	25	18	15	18	24	24	124
J. Snook	,, ...	June, 3rd week	,, ,,	10	50		...	675	24	18	18	17	27	20	124
W. H. Townsend	Currawa	May, 2nd week	August fallow	14	40	36	1,300	780	28	16	17	18	23	21	123
M. J. Dwyer ...	Federation	May, 1st week .	Sept. ,,	3	45		1,220	650	23	19	15	16	25	21	119
E. Tyler	,, ...	May, 2nd week	,, ,,	6	60	30	1,286	700	20	16	16	16	19	22	109

* One point for each bushel of apparent yield. † Maximum points, first crop, 24 points; second, 25 points; third, 26 points; fourth, 27 points; fifth, 28 points; sixth, 29 points; over six crops, 30 points. ‡ Maximum points, first crop, 24 points; second, 25 points; third, 26 points; fourth, 27 points; over four crops, 28 points.

DETAILS of Awards in the Eugowra Fallowing Competition.

Competitor.	Moisture, Max. 30.	Mulch, Max. 30.	Freedom from Weeds, Max. 30.	Consolidation, Max. 30.	Cultivation, Max. 30.	Total.
N. H. Pengilly	26	25	28	22	26	127
E. A. Collits ..	24	22	28	20	26	120
G. H. Pengilly ..	22	23	26	23	24	118
M. J. Dwyer .	22	20	29	20	26	117
G. W. Armstrong	25	15	26	22	24	112
W. M. Toohey ..	22	13	20	20	18	93

actually slightly exceeded it. Points were lost for the presence, although slight, of black oats and mustard, and for flag smut. The soil was a deep red volcanic loam, and the present crop was the twelfth grown on the same land. Graded seed at the rate of 50 lb. per acre was applied, and superphosphate at 56 lb. per acre. Sowing took place in the third week in May. The land was ploughed with the mouldboard 4½ inches deep, in the middle of August, and cultivated three times with the springtooth cultivator in October, January, and April. The success of this crop was due to fallowing, and the selection of good seed, properly treated and applied.

Mr. N. H. Pengilly.—This crop was Federation and Red Russian, grown on the alluvial soil adjoining North Bangaroo Stud Farm. It was sown in the last week of May, at the rate of 45 lb. graded seed, and 45 lb. superphosphate, per acre. It was the tenth crop in twelve years, and was the cleanest crop judged. Full points were awarded for the absence of disease, but points were lost through the presence of "strangers," particularly in Federation, unevenness in stooling and height, and because of wilting, and a tendency to burn off, due to insufficient moisture. The crop was estimated to yield 29 bushels. The land was disc ploughed in the first week in June, and harrowed twice, and cultivated three times with a heavy rigid tine-cultivator while in fallow. On the growing crop 8·08 inches of rain fell, and 15·22 inches on the fallow. These registrations were obtained from North Bangaroo Farm. Crops in the vicinity not grown on fallowed ground afforded striking evidence of the value of early and systematic working of the land.

Mr. H. F. Sweeney.—The crop entered by this competitor was the Federation crop with which this competitor won the Forbes Competition, and secured second place in the Champion Field Wheat Competition in the central west. It was grown on a medium heavy red soil, which had been fallowed since September, previous to which it had been utilised for grazing for about four years. The fallow received a discing in February, and was harrowed just prior to sowing in the first week in April. Graded seed at 50 lb. and superphosphate at 45 lb. per acre were applied. The yield was estimated at 27 bushels per acre. It was a very clean crop as regards weed growth, but points were lost for the presence of take-all and flag smut, for unevenness, and for the presence of "strangers."

The Prevalence of Diseases.

Bunt *(Tilletia tritici)*—This disease was only noticeable in one crop—Canberra—which speaks well for the care taken by the competitors in the selection and treatment of their seed. It has been noticed in other districts this year that Canberra seems particularly susceptible to this disease.

Loose Smut (*Ustilago tritici*).—Currawa and Improved Steinwedel both showed evidence of this disease, particularly the former. It was the only disease noticeable in the affected crop.

Take-all *(Ophiobolus graminis)*.—In the two crops which were grown on stubble ground, take-all patches were fairly prevalent. They were both Canberra. It was also present, though not to any extent, in two crops of Federation.

Foot-rot (*Helminthosporium sativum*).—This disease was present in one crop of Canberra and two of Federation; in the former more or less in small patches, but in the latter as groups of two or three plants scattered throughout the crop.

Flag Smut (*Urocystis tritici*).—This disease was present in eight of the ten crops and in at least four to an alarming extent. Federation, Canberra, and Improved Steinwedel were the varieties affected, and the yields were considerably reduced in consequence. It is more than likely that the dry conditions, which have prevailed practically ever since the land was first turned over, were responsible for the prevalence of this disease. The spores of the fungus, already in the soil, were probably unable to germinate because of insufficient moisture until the same time as the wheat, causing infection of the crop.

The Fallowing Competition.

The Association decided to conduct, at the same time, a fallowing competition of not less than 50 acres, for which they offered prizes of £5 and £2.

Although the correct time of judging such a competition is March or April, the Association particularly desired that it be judged at the same time as the wheat competition to save expense. It was accordingly carried out, the following scale of points being adopted:—

Cultivation	30 points.
Consolidation	30 ,,
Freedom from weeds	30 ,,
Moisture	30 ,,
Mulch	30 ,,

It was decided that the points could only be awarded according to the condition of the fallow at the time of judging in relation to its probable condition at planting time with the methods of cultivation being adopted.

The item "consolidation," or the condition of the subsurface, mainly with regard to its compactness, was particularly difficult owing to the small amount of work that had been done up to that time.

N. H. Pengilly.—This paddock was in excellent condition, having been disc ploughed early in July, harrowed in August and October, and cultivated with a heavy tine-cultivator in September, these operations being carried out in each case immediately after rain had fallen. A total of 6·68 inches of rain had fallen on the fallow. Loss of points occurred mainly through an uneven mulch, the presence of slight weed growth (Bathurst burr), slight unevenness in cultivation, and rather too loose condition of the subsurface. This fallow was worked much in the same manner as the crop with which Mr. Pengilly secured second place in the field wheat competition, which is something of a proof that his system is right. He is a strong advocate of fallowing, and the earlier the initial ploughing the better—in fact, it is his intention to summer fallow much of his land in the future.

E. A. Collits.—This fallow, a red loam, was ploughed with the mouldboard in July, cultivated with the springtooth in August and October, and harrowed in September. It had had 5½ inches of rain. Loss of points occurred through too much compaction of the soil immediately below the mulch, uneven

mulch, and slight weed growth. Much of the fault in this fallow could have been remedied by deeper setting of the cultivator. It was, however, very little inferior to the winning block.

The fallows entered by Messrs. G. H. Pengilly, M. J. Dwyer, and G. W. Armstrong were very little inferior to the winning blocks, and lost points through defects in cultivation methods which chiefly affected consolidation, the moisture content, and the mulch. Mr. Dwyer's was the cleanest of all the entries.

Comments on the Competitions.

The Eugowra P., A., and H. Association, which has only been in existence fifteen years, and which holds a one-day show in September of each year, is to be congratulated on entering the arena of crop and fallow competitions. Its action is due to a desire to improve farming methods in the district; to make the methods adopted by the winners the methods of the whole, and thus to increase by many bushels the wheat yields of the district, and hence its prosperity.

It was extremely unfortunate that the Association was not allowed to affiliate with the other districts associated in the Championship Field Wheat Competition, particularly as the crop entered by Mr. H. F. Sweeney, with which he won the Forbes competition and came second in the championship, was allotted third place in the Eugowra competition.

The conclusions which may be drawn from this competition are:—

1. The highest yields of wheat are obtained where early fallowing and cultivation of the fallows after rain are practised.

The nature of the season has helped considerably to demonstrate the benefits of good cultivation methods, and to bring home most forcibly the fact that fallowing is essential to ultimate success in wheat growing in districts such as this.

2. The application of superphosphate to the wheat crop is responsible for increased yields.

In several instances marked differences were noted between crops that were manured as against those that were unmanured. In one case where the drill had not sown manure, strips of wheat, thinner, shorter, later in maturity, and obviously much lighter in yield were to be seen in the crop.

In this district it would appear that over 56 lb. is not necessary, in fact is likely to be detrimental should soil moisture become deficient.

3. The presence of such weeds as black oats, wild mustard, barley grass, &c., is increasing, and cultivation methods that will secure cleaner crops must be adopted.

Briefly these methods consist in early fallowing (May being the most desirable month for controlling black oats), reducing the soil to a fineness and firmness that will induce weed-seed to germinate, and ultimately feeding off the young growth with sheep, or ploughing in before any sign of flowering appears.

4. That flag smut, take-all, and foot-rot, are becoming very prevalent, and greater care must be exercised in their control.

Foot-rot and take-all attack the crop in a more or less similar manner, and require the same control measures. These may consist of burning the stubble, early fallowing, keeping the ground free from weeds, such as barley grass (on which the fungus lives), rotating with oats, and the use of clean seed. The prevalence and the danger of the spread of flag smut does not seem to be fully realised by wheat growers. Its presence to a marked degree on 80 per cent. of the crops in this competition is evidence of its prevalance. Unfortunately it is not an easily controllable disease, owing to the spores of the fungus being distributed throughout the soil and on the grain at harvest time. Fallowing to secure a suitable medium for the germination of the spores, thorough burning of the stubble, rotating with oats, and pickling seed with bluestone or formalin as for ball smut, are measures of control which should be adopted.

Local Trials with Sunflowers as Silage.

The value of sunflowers as silage, particularly in the colder portions of the State where, on account of the short growing season, maize is likely to give smaller yields, has for the past year or two been the subject of particular investigation by the Department. Promising results have attended trials with sunflower silage as fodder, and in a recent issue of the *Gazette* was mentioned its usefulness in the feeding of dairy cows at Glen Innes Experiment Farm during last winter. In this connection a later report, by Mr. L. S. Harrison, acting manager of the farm, is of some significance:—

"While analysis proves the nutritive value of this silage to be very good, it is most essential that the question of palatability be not lost sight of, for whatever the analytical feeding value of a fodder, it must be judged in relation to palatability. The sunflower silage made on Glen Innes Experiment Farm in the past two seasons has now been all consumed by the cows, owing to the very dry spring and early summer. This silage was made by itself, with maize below and above, and when the sunflower silage was fed to the cows after the maize, although with concentrates (bran and linseed meal) they practically refused it, and only ate it with any degree of relish when mixed heavily with the maize silage. The sunflowers appear to have been very fine in the stalk and chaffed too short, causing this sappy fodder to be in a highly acid and mushy condition when opened up. This year the sunflowers were allowed to lie twenty-four hours in the field, and two knives were removed from the cutter in the expectation that the fodder will be in a more palatable condition. It is considered probable that if sunflowers were sown later, so as to synchronise with the maize in the ripening period, and the two were chaffed together, a most valuable and nutritious fodder would result."

Although good results have been obtained in the dry districts of other countries by sowing maize in widely-spaced rows, results so far obtained in trials at Bathurst Experiment Farm show no advantage in yield from maize sown in rows 8 feet apart as compared with rows 5 feet apart.—R. G. May, Manager, Bathurst Experiment Farm.

Jottings on the Past Season at Cowra.

J. T. PRIDHAM, Plant Breeder.

ALTHOUGH the year's rainfall in this district has been below the average, it has been generally remarked that the grain of the wheat has filled surprisingly well. This was due in part to frosty weather early in July checking too abundant growth. Dry weather at the end of September, continuing through October, (also somewhat dry) reached its height in November, which was a rainless month at Cowra. Cold weather early in August, too, checked the growth, otherwise the dry spring would have been disastrous. As it was the straw in the early varieties of wheat and oats ripened prematurely. Cool nights in October and November assisted the filling of the grain; but from lack of sap the straw became very brittle, and oats suffered particularly on this account. It was common to see a variety drying off before its time—the straw and ears showing a green tint, but the ripening process being arrested by drought.

Early Varieties of Oats.

It is possible that some farmers who have tried some new variety of oats for the first time will condemn it on the past season's experience. But it was a season when oats had to be stripped as soon as ever they were ready. Because of the greenish look of some patches of crop the oats may have been left too long, or else a crop of wheat may have been taken off first when the oats were ready. In some years the oat crop does not take such close watching, but last season there was a good deal of broken-down straw and grain lost from lodging. Tests were made of the straw of Lachlan and Algerian oats by hand-threshing a number of samples, and it could not be said that the one variety had any stronger straw than the other.

New Varieties of Wheat.

We have two or three new sorts coming on, and of the varieties already under test in larger areas, Waratah and Wandilla promise very well as grain wheats, and Gresley for hay. Waratah is of the same season as Hard Federation, and Wandilla resembles Yandilla King in time of sowing and general field qualities. Seed of these two will not be available for sale till next harvest. Gresley, a West Australian variety, is quite early, and bids fair to take the place of Firbank, especially for hay, though it is a satisfactory dual-purpose early variety. Until we get a better trio for this part of the central west we still pin our faith to Yandilla King (or Wandilla) for early; Hard Federation (or when available, Waratah) for mid-season; and Canberra for late sowing. For hay purposes, Warden or Zealand for early and Gresley for late sowing may be mentioned.

Field Peas.

We are continuing to grow this crop, believing that it has a place on the wheat farm. Where farmers can raise lucerne seed it may pay them better to use lucerne instead, allowing it to remain for three years, and then breaking the land up for wheat. We sowed the peas last year early in March, and the only rain in that month was 18 points on the 1st. Notwithstanding this the peas made very fair germination, and the crop was fed-off with sheep on 20th April, the weather continuing dry. Frosts checked the subsequent growth after good rain came, and it would have been better to have sown about the middle of April. Earlier sowing than this endangers the flowering and podding of the crop, especially in a dry frosty winter. However, a very satisfactory crop of peas, thickly covering the area, was ploughed in the last week of August, the peas being well podded and starting to ripen off. Canada is a good early variety, and there are two or three other promising sorts of which seed is not on the market. We are trying earlier varieties than the Grey and Blue peas, which are too late for this district.

While we do not yet advocate field peas for the wheat grower, they are certainly more satisfactory than rape, and at present are the most promising rotation crop with lucerne, of its class.

Foot-rot of Wheat.

Although this disease was not very prevalent, still it was present very unmistakably in wheat, oats, and barley. In some parts of the district as much as two-thirds of the wheat crop is reported to have been lost. It is the worst disease the farmer has to contend with in the wheat areas. The fact that plants are only partially attacked, leaving one or two perfectly healthy stalks, causes it to escape notice to a large extent. Much of the effect of this trouble is attributed to dry conditions of soil, when examination would reveal quite sufficient moisture for the needs of plants. The late Mr. Hamblin differentiated between foot-rot and take-all. The matter needs further investigation, as there is much confusion in the public mind, and no treatment has been discovered beyond more careful soil management, clean fallows, and crop rotation.

The Pedigree of the Milking Cow.

Before attempting to feed for milk production it is very necessary to have cows with the ability to milk bred into them for at least one generation of ancestry, and for as many more as possible. This does not necessarily mean the keeping of pure-bred cattle, but good grades that will pay their way at the pail. While good pure-bred dairy cattle properly managed will show a profit over grades, the carrying of grade cattle does not call for a specialised training to the same extent that the pure-bred business does.—F. H. Reed, in "Seasonable Hints," Canadian Department of Agriculture.

Farmers' Experiment Plots.

Wheat, Oat and Barley Experiments, 1922.

Western District.

H. BARTLETT, Senior Agricultural Instructor.

The farmers who co-operated with the Department in conducting cereal experiments during 1922 were :—

A. H. Newton, Yarrandale, Armatree.
Hughes Bros., "Greenacres," Pullabooka.
E. A. Draper, Harris Park, Alectown West.
J. Hobson, "Araluen," Bogan Gate.
J. Parslow, Kelvin Grove, Gilgandra.
F. W. McKenzie, Biddon, Gilgandra.
A. B. Mason, "Hartwood," Narromine.
R. J. O. Berryman, "Aviemore," Botfield.
J. M. Connor, "Kokum," Ootha.
J. S. Plowman, Emu Vale, Parkes.
W. W. Watson, "Woodbine," Tichborne.
S. Reilley, Jnr., Eurimbla.
W. E. Tayler, "Adavale," Coradgery.
Mailer Bros., Trundle Park, Trundle.
M. F. Dalton, "Duntry-league," Orange.

Cultural Notes.

Armatree.—Red loam ; new land ; mouldboard ploughed, August, 1921 ; disc cultivated, January, 1922 ; springtooth cultivated, 24th April ; sown 6th May with 45 lb. wheat and 56 lb. superphosphate per acre.

Pullabooka.—Red loam ; new land ; disc ploughed in September, 1921 ; disc cultivated on 8th March, 18th April, and again on 26th April ; sown 2nd May with 45 lb. wheat and 45 lb. superphosphate per acre.

Alectown West.—Red loam ; previous crop, winter fodders, 1921, manured with 30 lb. of superphosphate per acre. Mouldboard ploughed on 20th December, 1921 ; harrowed in January ; springtooth cultivated, 20th March ; disc cultivated, 24th May ; sown on 26th May with 45 lb. of wheat and 30 lb. of superphosphate per acre.

Bogan Gate.—Red to dark clayey loam ; new land ; disc ploughed, August, 1921 ; harrowed on 3rd and 26th January ; springtooth cultivated 1st March and 2nd May ; sown 12th May with 45 lb. of wheat and 37 lb. of superphosphate per acre.

Gilgandra (J. Parslow).—Light red to grey loam ; previous crop, winter fodders, 1921, manured with 56 lb. superphosphate per acre. Mouldboard ploughed, 4th August, 1921 ; disc cultivated, 15th October and 13th February ; springtooth cultivated, 7th March and 3rd April ; sown on 26th April with 44 lb. of wheat and 56 lb. superphosphate per acre.

Gilgandra (F. W. McKenzie).—Red sandy to grey loam, the sandy soil being feet in depth; previous crop, wheat, 1919, unmanured. Mouldboard ploughed, August, 1921; harrowed in April, 1922; springtooth cultivated in April; sown 24th April, with Canberra wheat, 48 lb. per acre, and various fertilisers.

Narromine.—Red loam to sandy loam; previous crop, wheat, 1920, unmanured. Mouldboard ploughed in July, 1921; springtooth cultivated in January and on 5th and 15th May; sown 17th May with 47 lb. of wheat and 41 lb. of superphosphate per acre.

Botfield.—Heavy red almost clayey loam; previous crop, wheat, 1920, unmanured. Mouldboard ploughed, 30th June, 1921; disc cultivated in September; springtooth cultivated in January, 1922; disc cultivated in February; springtooth cultivated 10th May; sown 11th May with 45 lb. of wheat and 37 lb. of superphosphate per acre.

Ootha.—Red loam; previous crop, wheat, 1918. Mouldboard ploughed, August, 1921; springtooth cultivated, January, 1922, 5th April and 8th May; sown 9th May with 40 lb. of wheat and 35 lb. of superphosphate per acre.

Parkes.—Fairly heavy red loam; previous crop, wheat, 1920, unmanured. Mouldboard ploughed, August, 1921; disc cultivated, September and February; springtooth cultivated, 15th May; sown 15th May with 44 lb. wheat and 40 lb. of superphosphate per acre.

Tichborne.—Light red loam; previous crop, winter fodders, 1921, manured with 56 lb. of superphosphate. Mouldboard ploughed, September, 1921; springtooth cultivated, 28th December; harrowed, 6th February and 25th April; springtooth cultivated, 16th May; sown 17th May with 50 lb. of wheat and 56 lb. of superphosphate per acre.

Eurimbla.—Fairly heavy red loam; previous crop, wheat, 1920, unmanured. Mouldboard ploughed, September, 1921; springtooth cultivated, November; skim ploughed, 15th April; sown 1st May with 56 lb. seed and 56 lb. of superphosphate per acre.

Coradgery.—Clayey loam; new land; mouldboard ploughed, July, 1921; disc cultivated, September; springtooth cultivated in January and 2nd May; sown 3rd May with 56 lb wheat and 56 lb. of superphosphate per acre.

Trundle.—Fairly heavy red loam; previous crop, wheat, 1920, unmanured. Mouldboard ploughed, 30th August, 1921; springtooth cultivated, 27th December; springtooth cultivated, 15th January; disc cultivated, 9th May; sown 10th May with 45 lb. seed and 55 lb. superphosphate per acre. Crop harrowed 9th August.

Orange.—Red loam; previous crop, Sudan grass, 1921–22, manured with 56 lb. of superphosphate per acre. Mouldboard ploughed, 12th April; harrowed, 17th April; sown 18th April with 60 lb. of wheat or 50 lb. of oats and 56 lb. superphosphate per acre. Harrowed, after drilling, 19th April.

The Season.

The months of July and August, 1921, were favourable for fallowing, there being sufficient rain to keep the soil in good condition for ploughing without seriously delaying the work. Only light rains were afterwards experienced till the end of December. From 2 to 3 inches were registered at that time and during January, but this was followed by almost droughty conditions, which, in some centres, continued until the end of June, when falls aggregating 50 to 150 points relieved the situation. Fair rains during July and August somewhat encouraged the wheat-growers, but the dry conditions recurring during September and October and in the early summer, accompanied by hot, drying winds, caused a serious shrinkage in crop prospects.

In all centres the rainfall for the year 1922 was considerably below the average, and but for the copious December rains (of 4 to 6 inches), many places would have experienced the driest year on record.

Effects of the Dry Weather.

Owing to the light rainfall during the fallowing period, August, 1921, to April, 1922, very little weed growth occurred, which in one way was an advantage, though in other respects a serious disadvantage. It certainly saved the farmer a considerable amount of work, inasmuch as there was no necessity to work the fallow to destroy the weed growth. The elimination of the cultivations on this account, however, left the subsurface soil in a loose, open condition, instead of being nicely consolidated. Then again, weed seeds—which are absent from only the most carefully-worked farms—did not germinate until after the April sowings, and paddocks once thought clean proved disappointingly dirty.

The conditions during the period April to June, 1922, were distinctly unfavourable for germination, and the few light rainfalls registered were in many instances sufficient to promote germination, but insufficient to carry the seedlings above ground. Some paddocks in the Peak Hill and Parkes districts were sown as many as three times.

In the Dubbo and Gilgandra districts the germination, though late, was fairly satisfactory, as the wheat, being sown in a dry seed-bed, which continued dry until the good rainfall of 26th June, did not malt or sprout to the same extent as during the earlier months.

The late germination and the dry conditions during the growing period retarded stooling, making the crops thin and inclined to spindle. Some of the April-sown crops of early varieties, which had germinated soon after sowing, were showing a few ears on 5th August, which is far too early for the crops to be safe from frosts.

About the middle of October, when crops were in the dough stage and "burning off," a fall of half an inch of rain was of untold benefit, arresting the "burning off" process, and enabling many crops to mature plump grain.

Fine conditions prevailed throughout the harvest, which commenced in the first week of November, and was practically completed by the end of that month.

The results of the various trials are given in the accompanying tables :—

Rainfall during Fallow and Growing Periods.

—	Bogan Gate.	Gilgandra (J. Parslow).	Trundle and Botfield.	Tichborne.	Coradgery.	Gilgandra (F. W. McKenzie).	Gulargambone (A. H. Newton, Armatree).	Parkes.	Ootha.	Pullabooka.
During Fallow Period.										
1921.	points.	points.	points.	points.	points.	points.	points.	points.	points.	points.
August	177	165	141	163	152	165	147			
September ..	150	108	105	135	91	108	148			
October	79	86	51	49	110	86	156			
November ..	65	202	129	60	98	202	260			
December ..	333	313	484	386	327	313	350			
1922.										
January	154	193	114	91	192	193	254			
February	38	26	1	56	27	26	40			
March	5	..	..	..	..	..				
April .. .	85	78	42	142	126	73	62			
Total . ..	1,086	1,166	1,130	1,082	1,123	1,166	1,417			
During Growing Period.										
May..	109	27	86	96	96	15	.	96	82	88
June	123	124	62	168	117	140	133	180	115	61
July	201	169	176	211	165	289	299	229	177	132
August	123	83	117	111	86	30	68	101	106	147
September ..	67	83	23	98	64	69	30	40	50	48
October	86	70	51	103	42	75	58	18	51	68
Total . .	709	506	452	787	570	618	588	664	581	594

Results of Variety Trials.

Variety.	Armatree.	Pullabooka.	Alectown West.	Bogan Gate.	Gilgandra (J. Parslow).	Narromine (Hartwood)	Botfield.	Ootha.	Parkes.	Tichborne.	Eurimbla.	Coradgery.	Trundle.
	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.
Hard Federation .	10 22	11 30	13 16	11 21	9 18	7 32	10 8	7 52	27 50	18 20	12 52	16 11	8 18
Federation .	..	..		..	10 10	..	13 10	10 20	26 41		..	17 29	..
Gresley .. .	10 23	11 5	14 25	10 56	9 46	8 44	7 8	7 16	21 6	17 53	20 21	13 46	8 59
Clarendon .. .	11 22	10 14	..	.	9 33	8 32	7 42	..		..	12 28	..	..
Marshall's No. 3 .	9 18	10 48	15 28	.	..	..	8 20	8 0	29 4		24 18	18 25	.
Yandilla King ..	.	..	..	.	.	.	..	.	26 58	..	..	18 15	10 27
Canberra* .. .	5 33	11 3	9 0	11 51	6 4	6 0	4 49	4 45	21 44	14 15	14 29	13 34	6 55
Currawa	8 34	10 9	..	..	10 46	7 13	.	..	..		24 41	..	.
Bomen ..	. .	..	..	..	.	..	..	..	.	..	..	..	7 34
Hamel .. .	.	..	.	..	..	10 16	..		21 6	..	..	..	11 35
Imp. Steinwedel ..	..	..	..	6 33	..	7 45	.	11 24		13 47	..	..	..
Firbank	..	..	..	12 17	.	..	..	.	..	..	..	..	..
Sunset	..	.	..	11 51	..	..	.	..	..	..	..	..	..
Bunyip	..	..	13 38	..	..	..	..	.	.	..	..	..	..
Waratah .. .	.	..	9 27	..	..	..	..	..	..	..	..	..	..
College Purple ..	7 27	..	..	.	..	..	..	..	..	..	..	..	..
Florence	..	..	..	..	.	..	..	4 37	..	.	..	..	..
Wilfred .. .	..	..	..	..	9 29	..	..	..		.	..	..	..
Plowman's No. 110..	..	.	..	..	..	..	..	..	24 9	..	..	..	..
Plowman's No. 4 ..	..	..	..	..	..	..	..	..	21 37	..	..	..	..
Plowman's No. 187..	.	..	..	..	..	..	..	..	21 27	..	..	..	..
Plowman's No. 8 ..	..	..	..	..	..	..	..	..	19 36	..	..	..	..
Major..	..	..	..	..	..	..	..	..	..	12 17	..	..	..

* The germination of Canberra was exceptionally poor throughout all plots.

Hay Yields—Orange.

	t.	c.	q.	lb.
Wheat—				
Warren	1	14	2	22
Gresley	1	11	1	0
Bomen	1	9	3	21
Oats—				
Mulga	1	19	1	18
Lachlan	1	19	1	6
Algerian	1	17	0	2

Fertiliser Trial.

A fertiliser trial was carried out by Mr. F. W. McKenzie at Biddon, near Gilgandra, upon a deep red to grey sandy soil that has always failed to produce satisfactory crops.

Fertiliser Trial at Biddon.

	bus.	lb
Superphosphate, 84 lb. per acre	9	22
No manure	4	42
Superphosphate, 56 lb., muriate of potash, 14 lb., and sulphate of ammonia, 28 lb. per acre	8	26
Superphosphate, 56 lb., and muriate of potash, 14 lb.	8	11
No manure	5	4
Superphosphate, 56 lb., and sulphate of ammonia, 28 lb.	8	52
Superphosphate, 56 lb.	7	35
No manure	5	10

The germination of the plots was rather thin and patchy, and the growth varied up to 2 feet in height.

The increase in yield from the application of superphosphate is very marked, the heavier application, 84 lb., giving the highest yield. Sulphate of ammonia and muriate of potash only slightly influenced the yield.

In addition to the above experiment, a manurial trial was incorporated with each of the wheat experiments, and the returns are set out below. It will be observed that in every case the application of superphosphate gave an increased return.

Fertiliser Trials

—	Pullabooka.	Alectown West.	Bogan Gate.	Gilgandra (J. P[illegible])	Narromine	Botfield	Ootha.	Parkes.	Tichborne.	Eurimbla	Coradgery.	Trundle.
Variety	Hard Fed.	Hard Fed.	Hard Fed.	Currawa.	Hard Fed.	Hard Fed.	Hard Fed.	Hard Fed	Hard Fed	Hard Fed.	Federation.	Hard Fed.
Superphosphate per acre.	45 lb	30 lb.	37 lb.	50 lb.	41 lb	37 lb.	35 lb.	40 lb.	56 lb.	56 lb.	56 lb.	55 lb.
	b. lb.	b. lb.	b. lb.	b. lb	b. lb.	b. l .	b. lb.	b lb.	b. lb	b. lb.	b lb.	b. lb.
Manured	11 30	13 16	11 21	10 46	7 32	10 3	7 52	27 50	18 20	12 52	17 29	8 18
No manure	8 40	10 44	10 46	13 26	4 37	5 7	6 42	21 36	15 12	10 7	8 35	4 49
Increase from manure	2 50	2 32	0 35	0 20	2 55	4 56	1 10	6 14	3 8	2 45	8 54	3 29

Central-western District.

W. D. KERLE, Senior Agricultural Instructor.

CEREAL experiments were sown in the 1922 season with the following farmers, in centres representative of the central-western district:—

H. J. Thompson, "Tilga," Canowindra.
Wm. Burns, "Goongirwarrie," Carcoar.
Robinson Bros., Tallawang.
L. C. J. Broughton, "Berrima," Mendooran.
V. Granowski, Mooren, Binnaway.
F. Stacey, Combandry, Gulgong.
L. C. Sands, Gulgong.
H. B. Loveband, "Blenheim," Coonabarabran.

The plots consisted of wheat trials at seven, and oat and barley trials at two centres. Results were not obtained from the plots at Gulgong and Coonabarabran, which failed owing to drought.

The Season.

RAINFALL from sowing to maturity.

Locality.	Date of Sowing.	May	June.	July.	Aug	Sept.	Oct.	Nov.	Total.	Date mature.
		pts.	pts.	pts	pts	pts.	pts.	pts	pts.	
Carcoar	15 May.	10	146	636	209	163	172	Nil.	1,336	30 Nov.
Canowindra..	24 ,,	Nil.	129	322	96	28	112	Nil.	687	30 ,,
Tallawang ...	15 ,,	Nil	155	268	109	16	97	28	673	25 ,,
Mendooran	13 ,,	11	99	113	74	Nil.	61	Nil.	358	15 ,,
Mooren	13 June	Nil.	70	264	46	113	Nil.	255	748	4 Dec.

The rainfall for the wheat season of 1922 was much below the average throughout the central west. The North western Slopes, as represented by Tallawang, Mendooran, and Mooren, experienced most unfavourable weather. Sowing was delayed considerably owing to dry conditions, and germination was slow and more or less patchy. The only good fall experienced during the season was in July, but only light falls followed, getting lighter as the season advanced. On the other hand the Central-western Slopes were more fortunate in getting better rain in August and October, although September and November were dry and hot, the latter month particularly being responsible for a big reduction in the yields.

In the north-western district very little grain was harvested. The majority of the crops were so poor that they never matured grain, and the district did not secure even its own seed requirements. Except where perhaps a crop on stubble ground received the benefit of an isolated thunder shower, it was only off land that had been fallowed that any return was obtained, and the district average yield was very low because fallowing is not generally practised—though strong evidence of its value is annually supplied by those who adopt that method.

On the contrary, failures were very few in the central west around Cowra, Canowindra, Forbes, Parkes, &c., because fallowing is there a general practice, although in some instances lower rainfalls were actually recorded.

The cultural details are presented in Table I.

Rotation Systems.

At all centres the paddocks set aside for wheat experiments are worked on definite rotation systems. At Canowindra and Mooren they are a simple two-course rotation consisting of (1) wheat, and (2) fallow. At Carcoar a two-year rotation consisting of (1) cereals, (2) fodder crops, and (3) potatoes, has been in operation for eight years, and has resulted in increased returns as well as an evident maintenance of the fertility of the soil and of freedom from weeds and fungus diseases. It is a farm method that might well be more generally adopted in this locality, where the soil is far from being fertile.

At Tallawang a two-course rotation consisting of (1) winter fodders (Cape and Skinless barley with field peas) and (2) wheat, has been adopted with much success. The yields obtained this season (over 20 bushels on less than a 7-inch rainfall) would appear to be due in no small measure to this system, since the preparation of the soil was far from thorough. It consisted of one ploughing in November after the sheep had been taken off, left in the rough, re-ploughed again in March, and left untouched until the day previous to sowing, when it was "spring-toothed."

The rotation recently adopted at Mendooran, where the soil is a light sandy loam, is a three-year one consisting of (1) winter fodders and fallow, (2) wheat for grain, and (3) oats or barley for grain. This is only the second season that it has been in vogue, and hence it is too early to judge whether it is a workable system for the locality.

A rotation system that can be economically worked in with the class of farming he practises should be the aim of every farmer. It might necessitate keeping more sheep than is usual, but that could not be considered a disadvantage. Only by such a system can consistently heavy returns be obtained, and yet the soil be maintained in its fertility and be kept free from weeds and disease, and in good physical condition.

Fertiliser Trials.

Locality.	Variety.	Superphosphate ½ cwt per acre.	No manure.	Increase due to Superphosphate.
Grain Yields.				
		bus. lb.	bus. lb.	bus. lb.
Tallawang ..	Hard Federation ...	16 0	10 0	6 0
Canowindra ...	Federation	30 2	12 12	17 50
Mooren	Hard Federation ..	15 32	13 5	2 27
Mendooran ...	Hard Federation ...	12 0	7 10	4 50
Hay Yields.				
		t. c. q. lb.	t. c. q. lb.	q. lb.
Carcoar	Cleveland	2 11 2 16	2 11 0 8	2 8

TABLE I.—Cultural Details of Cereal Experiments, 1922.

Name and Address.	Nature of Soil	Previous Crop	Cultivation of Soil.	Date of Sowing.	Amount of Seed.	Amount of Super-phosphate.	Rainfall on— Fallow.	Rainfall on— Growing Crop.	Date of Harvesting.	Remarks.
Wm. Burns, "Goongirwarrie," Carcoar.	Light clay loam.	Potatoes; harvested April, 1922.	21st April, 1922, mouldboard ploughed, 5 inches deep; 14th May, harrowed.	15th May, 1922.	90 lb.	56 lb	—	13·36	2nd December.	Hay trial only. Definite rotation with fodder crops and potatoes followed. Soil in excellent condition at sowing. Germination excellent. Height of crop from 4 to 5 feet.
H. J. Thompson, "Tilga," Canowindra.	Red sandy loam; granite.	Wheat, 1920.	18th March, one-way disc, 3 inches; 23rd August, disc ploughed, 5 inches; 27th September, one-way disc; 29th January, one-way disc; 12th May, one-way disc; 23rd May, spring-tooth cult.	24th May, 1922.	40 lb.	56 lb.	26·08	6·87	10th December.	Paddock bad with black oats, and long fallowed and worked, as shown, to eradicate. Subsequent crop still oaty. Germination very good; growth excellent for the season. Height of crop, 2 feet 6 inches to 3 feet 6 inches.
obinson Bros., Tallawang.	Red loam; granite.	Fodder crops, 1921.	11th November, mouldboard ploughed, 5 inches; 15th March, re-ploughed; 14th May, spring-tooth cult.	15th May, 1922.	58 lb.	58 lb.	11·26	6·73	29th November,	Rotation of fodder crop, fallow and wheat, adopted. Germination patchy. Height 2 to 3 feet; even. Easily the best crop in the locality.
L. C. J. Broughton, "Berrima," Mendooran.	Light sandy loam.	Fodder crops, 1921.	3rd September, mouldboard ploughed, 5 inches; 31st January, one-way disc, 10th May, spring-tooth cult.	13th May, 1922.	Wheat, 58 lb.; oats, 55 lb.; barley, 50 lb.	56 lb.	8·93	3·58	15th and 29th November.	Rotation as Tallawang practised. Height—wheat, 18 inches to 3 feet. Oats, Algerian, 4 feet; Lachlan and Sunrise 18 inches. Barley 18 inches. Grain pinched; season very dry in this locality.
V. Granowski, "Mooren," Binnaway.	Light sandy loam.	Wheat, 1920.	3rd September, disc ploughed; 1st November, spring-tooth cult.; 6th February, one-way disc, 12th June, harrow.	13th June, 1922.	58 lb	56 lb.	11·94	7·48	11th to 13th December.	Germination satisfactory; stooled thinly. Height 15 inches to 2 feet. Sunset and Florence shelled out rather badly. Season very dry here, November rains too late.

TABLE II.—Hay and Grain Yields, 1922.

Name of Variety.	Grain Yields.				Hay Yields.
	Canowindra.	Tallawang.	Mendooran.	Mooren.	Carcoar.
Wheat—	bus. lb.	bus. lb.	bus. lb.	bus. lb.	t. c. q. lb.
Federation ...	30 2	......	......	......	......
Canberra ...	29 43	18 40	18 5	13 50	......
Waratah ...	27 37	20 40	......	......	......
Penny ...	26 6	......	......	......	......
Bomen ...	21 1	......	......	......	......
Marshall's No. 3 ...	19 30	......	......	......	......
Onas ...	......	19 14	......	......	......
Hard Federation...	......	16 0	12 0	15 32	......
Yandilla King ...	......	14 48	6 15	8 42	......
Major ...	......	13 18	4 40	......	......
Zealand Blue ...	......	12 4	......	......	......
Florence ...	......	......	18 20	6 7	......
Currawa ...	......	......	12 30	......	......
Sunset ...	......	......	......	8 53	......
Cleveland ...	......	......	......	......	2 11 2 16
Zealand ...	......	......	......	......	2 4 3 16
Warden ...	......	......	......	......	2 4 1 12
Gresley ...	......	......	......	......	2 5 1 25
Oats—					
Algerian ...	......	......	18 2	......	......
Lachlan ...	......	......	12 10	......	......
Sunrise ...	......	......	10 0	......	......
Barley—					
Cape ...	......	......	21 7	......	......
Trabut ...	......	......	7 0	......	......

Comments.

Canberra and Hard Federation have again demonstrated their ability to yield well under drought conditions. Two other varieties that are outstanding are Waratah and Onas. The former originated at Wagga Experiment Farm in 1907 from a cross between Hudson's Early Purple Straw and Gluyas. It is a midseason variety with semi-solid straw of good colour. It has a tip-awned brown ear, and holds the grain well. Onas is a South Australian production whose pedigree is Federation x Tarragon, the latter a wheat similar in many respects to Cleveland Onas is an early to mid-season dual-purpose variety. Penny, which did well at Canowindra, is a selection made by a farmer in Victoria; it has in many ways the same characteristics as Dart's Imperial.

The application of superphosphate to the wheat crop has been particularly beneficial this year throughout the central west. In the grain experiments big increases were obtained. Right from germination the effect of the fertiliser was most marked. The increase at Canowindra was not all due to superphosphate. Black oats were bad in the whole paddock, despite every effort to eradicate that the season would allow, and exceptionally bad in the unmanured block, causing a loss of yield in the wheat. Increases have, however, always been obtained at this centre, 42 lb. superphosphate giving an increase of $4\frac{1}{2}$ bushels last season with Hard Federation.

The yields obtained in these trials, with so meagre a rainfall in the growing period, were due primarily to fallowing, and to the systems of rotation adopted. That such well-known wheats as Canberra and Hard Federation gave average yields of 17 bushels and 14½ bushels respectively for three centres representative of the North-western Slopes, on an average rainfall for the growing period of 5·93 inches, is undeniable evidence of the possibilities of wheat-growing under improved methods of cultivation.

That there is urgent necessity for the adoption of these improved methods is evidenced by the fact that the wheat harvest in this district was almost a complete failure.

A "Hopper Dozzer" for Destroying Beetles.

The problem of dealing with the infestations by the Yellow Monolepta beetle (*Monolepta rosæ*), which have lately been troubling cotton-growers on parts of the North Coast, suggests the use of a "hopper dozzer" or oil dish. This method has been applied with good effect in the case of cherry trees heavily infested with Rutherglen bug and of potato crops attacked by climbing cutworms, and would probably be just as efficacious in connection with cotton crops infested by Monolepta or other beetles.

The best time of the day to put the hopper dozzer into operation is in the early morning before the sun has risen, when the pest insects are at rest on the foliage and while they are still in a semi-torpid state.

Take a 9-feet sheet of galvanised iron, turn up the sides and ends about 6 inches all round, so as to make a long shallow dish, and to one end of this affix a handle or ring for the attachment of a rope. Pour into the dish a couple of inches of water and then sufficient kerosene to form a good film. The appliance is now ready for use, the operator merely dragging it between the rows of infested plants, an assistant (or two if the infestation is very serious) armed with a stick or an old broom bending the plants over toward the dish as it is dragged by and brushing and shaking their foliage. The insects so dislodged drop into the oil film in the dish and are instantly killed.

The size and shape of the dish can be made to suit the conditions of the crop and the width between the rows, and where the area to be treated is a large one two pairs of low wheels on axles may be fixed underneath the contrivance to facilitate the work.—W. W. Froggatt, Government Entomologist.

Poultry-farmers and Co-operation.

It is encouraging to note the efforts put forward by branches of the Agricultural Bureau and poultry societies for co-operation in purchasing poultry food and supplies. Miranda, Carlingford, Wentworthville, Blacktown, and recently Eastwood are notable instances of the benefit to poultry-farmers arising out of such organisation. This is one way by which a reduction in cost to the consumer and greater profit to the producer can be brought about. By making wheat available direct to poultry-farmers in 1918 the Department showed the way to collective purchase of poultry foods. The Department is doing much to encourage this class of organisation among poultry-farmers.—James Hadlington.

Lamb-raising Trials.

CORRIEDALE *versus* DORSET HORN.

F. B. HINTON, Sheep and Wool Expert.

IN all up-to-date systems of mixed farming sheep play an important part, and of the various lines suitable to the wheat and sheep farm, none offers greater possibilities of profit than raising fat lambs, and certainly none gives such quick returns.

Lamb-raising means the raising of a lamb whose carcase will attain the weight demanded by the export trade at or before the weaning stage, *i.e.*, 4 to 5 months. This weight is from 33 lb. to 40 lb. Lamb carcases scaling between these weights are termed "firsts," while those from 28 lb. to 33 lb. constitute the second grade, and those from 26 lb. to 28 lb. the third grade, due regard, of course, being had for the shape of the carcase. The carcase should be plump, well rounded, and with the flesh equally distributed as far as possible over all parts. Previous experiments by the Department of Agriculture have proved that the first cross lambs obtained by mating longwools with Merinos usually scale from 28 lb. to 30 lb. Opinions of experts both in Australia and abroad have been obtained from time to time by the Department, and they all agree that first-crosses are too long and slender and lack the compactness, plumpness, and finish of second-crosses, usually being classed as third grades.

In an endeavour to ascertain the best combination of breeds for the production of first grade suckers, and incidentally in the hope that it may be possible to place this branch of the wool and mutton industry on a better footing, practically every breed in Australia has been tested, either in the pure state or as a crossbred, by this Department.

Exhaustive experiments with all the then available breeds were conducted between 1912 and 1919 at Wagga, Cowra, and Bathurst Experiment Farms, and the data obtained proved conclusively the superiority of the Dorset Horn rams mated with first-cross longwool-Merino ewes as producers of fat lambs over all other breeds tried. Not only does this combination produce the required quality of mutton and shape of carcase, but the results showed that lambs from this combination were marketable earlier than from any other. This is one of the chief factors in most wheat districts, it being essential that the lambs be ready for market before the natural pastures dry up and the grass-seed nuisance commences. It may be thought that this danger could be obviated by an earlier mating, but experience proves that

operations have to be co-ordinated with the breeding instincts of the ewe and the inclination of the ram to work, and also that the lambs should be born when a suitable food supply is available. The latter is another important factor determining the success of lamb-raising, as without fodder crops or a reserve of fodder, the absence of rain at the required time may cause the holding over of the complete drop of lambs till a later age. It will readily be understood that to attempt this would be fatal to the farmer who keeps his farm stocked to its full carrying capacity with breeding ewes. This fact also again emphasises the need for early maturity. As a general rule it has been the experience of the Department that it is better to quit the lambs at the five-months' stage, even though the season be an "off" one, rather than run the serious risk of overstocking by carrying the lambs over to a later age.

During 1921 representations were made to the Department by the Australian Corriedale Sheepbreeders' Association, asking that the Corriedale breed be tested, and in consequence a trial was commenced at Wagga Experiment Farm in December, 1921, to test the capabilities of the Corriedale rams as lamb-raisers. The combination of breeds recommended by the Department, *i.e.*, the Dorset Horn ram, mated with first-cross Border Leicester x Merino ewes, naturally formed the basis of comparison, and the results of the experiment are appended. It is not proposed to give a description of either of the breeds used as sires.

For the experiment the flock of 846 six-tooth Border Leicester x Merino ewes was divided into two flocks and apportioned to each breed of rams. No preference was given when separated, the ewes being drafted through the race ten at a time each way. Distinguishing marks were put on each of the ewes.

Mating commenced on 14th December, ten rams of each breed being used. The Corriedale rams, which were purchased from the President of the Australian Corriedale Sheepbreeders' Association, were four-tooths, while the Dorset Horn rams, which had been bred at Wagga Farm, were 4, 6 and 8-tooths. The rams received only the usual attention before mating. The Dorset Horn group was mated on natural pasture only, and the Corriedale group on natural pasture and fallow. No yarding took place during mating. The Dorset Horn rams commenced service on the date of joining, but the Corriedales did not commence till four days later. The rams were removed on 30th January—six and a half weeks after joining, and the two groups of ewes were boxed the same day.

Owing to a dry spell, hand-feeding had to be resorted to and the ewes received an average of 2 lb. of silage per head per day throughout April, to augment the dry feed. During pregnancy three ewes of the Corriedale group and one of the Dorset Horn group died, the cause being lung troubles and not pregnancy.

The Lambing.

The flocks were separated to lamb, and both lambed on natural pastures having access to stubble land for four days each alternately. Both groups lambed well, and the following table shows the number of ewes which received assistance at parturition :—

ASSISTED Parturitions

Group of Ewes.	No. in Group.	No. Assisted.	Deaths.
Dorset Horn ...	422	8	Nil.
Corriedale ...	420	3	Nil.

CAUSES of Obstructed Births.

Group of ewes.	Head only presented.	Head and one foreleg.	Forelegs not forward enough
Dorset Horn ...	1	1	6
Corriedale ...	1	1	1

LAMBING Percentages.

Group	Ewes mated.	No. of lambs dropped.	Per cent. dropped.	Lambs marked.	Per cent. marked.	No. of twins	No. of ewes at lambing.
Dorset Horn	423	407	96·2	391	92·4	21	422
Corriedale	423	396	93·6	385	91	18	420

The lambs were marked at an average age of six weeks and after the lambs were ear-marked for identification the groups were boxed, and allowed to run on green feed (Skinless barley) for two days before being returned to natural pastures. From marking onwards the flock had the run of two natural pasture paddocks, one stubble paddock, and in addition had the run of 100 acres of Skinless barley for thirty-six days at various intervals.

At marking time the Dorset Horn cross lambs were slightly larger than the Corriedale cross. During the wet weather in July the lambs suffered a slight check which was more noticeable in the Corriedale cross. During a week of hot weather in October the Dorset Horn cross lambs lost a little condition, but the Corriedale cross showed no ill effects. Between marking and trucking three Dorset Horn lambs and two Corriedale cross lambs died.

INCREASE in Weights of Lambs.

Breed of Lamb.	Average Increase between 2 and 3 months.	Average Increase between 3 and 4 months.	Average weight prior to marketing of first draft (five months old).
Dorset Horn cross	13·7 lb.	13·5 lb.	82·4 lb.
Corriedale cross ...	11·6 lb.	12·2 lb.	74·2 lb.

At trucking, the Dorset Horn cross lambs were larger than the Corriedale cross, and although there were some very good lambs among the latter they were not so even as the Dorset Horn cross. The Dorset Horns were well-made lambs with good bodies, well ribbed up, with good rumps and good open faces. The Corriedale cross were smaller on the average and not so well shaped, being comparatively long in the body, flat in the ribs, very woolly round the head and face, and with not such good rumps as in the Dorset Horn cross. Very little trouble was experienced with the blow-fly; in all only twenty lambs were struck, and of these fourteen were Corriedales.

The lambs were marketed in three consignments as they became ready, and were of an average age of five months.

PRICES realised at Homebush.

Cross.	First Draft. No. sold.	First Draft. Average price	Second Draft. No. sold	Second Draft. Average price	Third Draft. No. sold.	Third Draft. Average price	Total sold.	Average price.
		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Dorset Horn ..	203	1 1 6·6	100	0 19 4	40	0 15 0	343	1 0 1½
Corriedale	203	0 19 8·6	100	0 15 7·9	40	0 11 3	343	0 17 6½

The results obtained showed the Dorset Horn cross to an advantage of 2s. 7d. per lamb, and when the return per ewe mated is considered it will be noted that the Dorset Horn cross still retains its extra value. A certain number of lambs were unfit for Homebush saleyards, and after marketing equal numbers of both crosses the culls were retained on the farm.

RETURN obtained per Ewe mated.

Cross.	Lambs sold.	Average price.	Lambs retained at farm.	Valued at per head.	Total value of Lambs	Ewes mated.	Return from lambs per ewe mated.
		£ s. d.		£ s. d.	£ s. d.		
Dorset Horn ...	343	1 0 1½	45	0 14 0	376 16 3½	423	0 17 9¾
Corriedale	343	0 17 6½	40	0 10 3	321 7 5½	423	0 15 2

The data obtained from this experiment shows that there is little difference between the two breeds in point of parturition troubles, there being no deductions to make from the account sales of lambs sold for deaths in ewes at parturition. The Dorset Horn cross, as will be noted from the final return, proved its superiority for prices obtained, and from observations made during the growth of the lambs, it has undoubted earlier maturing capabilities than the Corriedale.

It has been suggested that were it necessary to hold the lambs over to a later stage, the Corriedale cross would prove superior, but as this line of action is not recommended by the Department and is so very seldom necessary in the wheat belt, this point does not concern the experiment. It must be remembered that the object of this experiment was to prove which of these two combinations of breeds was the superior for the production of fat lambs.

Farmers' Experiment Plots.

Winter Green Fodder Experiments, 1922.

Central Coast.

J. M. PITT, Senior Agricultural Instructor.

The number of farmers co-operating with the Department in conducting trials with the above was slightly in advance of the previous year. They were as follows:—

J. G. Ward, Sherwood, Macleay River.
A. C. McLeod, Mondrook, Manning River.
R. Richardson, Mondrook, Manning River.
John Lambert, Taree Estate, Manning River.
F. Brewer, Taree Estate, Manning River.
Hubert Flett, Taree, Manning River.
J. P. Mooney, Dumaresque Island, Manning River.
B. Richardson, Dumaresque Island, Manning River.
A. H. Norris, Mount George, Manning River.
G. Richardson, Mount George, Manning River.
A. R. Longworth, Jones' Island, Manning River.
M. Smith, Paterson, Paterson River.
Alex. Smith, Bandon Grove, Williams River.
T. H. Pearse, Hinton, Hunter River.
R. Apps, Miller's Forest, Hunter River.
S. J. Dawson, Burrapine, Nambucca River.
Members of Hannam Vale Agricultural Bureau.

In addition, some surplus seed from Mr. F. Brewer was sown by Mr. P. McCaffrey, also of Taree Estate. It is gratifying to note that winter fodders were grown to a much greater extent during the autumn of 1922 than hitherto. This was most noticeable along the Macleay River, where the usual large area sown to field peas and vetches was supplemented by many acres of cereal crops. Amongst the men of long experience in winter fodder growing, the mixed plots (oats or wheat, with a legume like field peas or vetches added), are now the most popular, owing to the better balanced fodder and the greater yield obtained, as compared with the cereal alone or the legume alone.

Oats are still by far the most widely-grown single crop—Algerian for grazing purposes, and Sunrise for cutting—and they are regarded as the best of the winter fodders from a milk-producing point of view. On the other hand, there are men of long experience who strongly prefer barley. The area sown to this cereal is almost negligible, the majority of crops being rather poor, probably owing to the plant requiring a richer soil or better working than is usually given other winter fodders.

Wheat alone is not regarded as quite as valuable for milk-producing purposes as the crops already mentioned. Still, different varieties have their admirers, and where a legume is included in the plot they are very little inferior. In very wet or very dry seasons wheats are surer croppers than barley or oats, and they do well in situations to which the other small cereals

are not suited. The majority of the early-maturing varieties (in fact, the majority of wheats) are poor stoolers, and are somewhat deficient in leaf growth. Still, the early-maturing sorts are preferable to those maturing late, chiefly because they are available early. They "leave" the ground quickly, and are thus less interfered with by heavy winter rains than are the later and more procumbent sorts. Moreover, they reach their maximum growth before the almost certain visitations of spring rust. The usual practice is to grow different varieties at different times, so that they will be available in rotation during July, August, and early September—the lean months of the year.

Two good crops at Mr. J. Lambert's Taree Estate.
On the left, Bomen wheat; on the right, Sunrise oats.

The Time of Sowing.

April sowings were again undoubtedly the best. The soil is usually warm at that time, and the young growth, coming away quickly, is maintained throughout. With May sowings the young plants somehow remain dormant, probably owing to striking colder weather at an earlier stage of growth. Sowing in June in many seasons has been preferable to May. With the advent of August the days again become warmer, and there is ample time for early maturing varieties to grow before the hot weather begins. These sowings, however, are more subject to spring rust than those sown in April.

Cultural Operations.

In many instances, the preparation of the seed-bed is still carried on very roughly. Farmers should bear in mind that their work is reflected in the resulting crop. Often inferior soils well worked will give quite as good returns as the best poorly worked. An increase of 25 to 50 per cent. can be expected with the best work, or, in other words, 2 or 3 acres well worked will return as much fodder as 3 to 5 acres "roughed."

It is surprising the number of dairymen who still make no provision for winter fodder. Pastures during June, July, and August are very short, and cattle invariably lose in condition. One would be quite safe in estimating that during those months 1 acre sown to fodders would yield more in bulk than 10 to 15 acres of average pasture. An area of 4 acres yielding 40 tons of fodder—a very conservative estimate—would give thirty dairy cows 50 lb. of fodder per head daily for nearly two months. This is not a difficult proposition, and farmers might well consider the matter in this aspect.

Varieties and Yields.

Sunrise oats, with a legume included, gave the greatest bulk of fodder. The plots with field peas or vetches included some yields so far in advance of the "cereal alone" plots as to be almost unbelievable. Algerian oats, although yielding well, have lately, owing to their later maturity and very slow early growth, been largely superseded by the quicker-growing Sunrise. For grazing, however, Algerians are still largely used. Lachlan, Guyra, and Quondong were not conspicuous.

Drawing in a slide load of green fodder at Mr. R. Richardson's farm, Mondrook, Manning River.

Although comparatively low in the table of yields, the broad, rich, succulent, leaf-producing Currawa created a very favourable impression on the season's performances. Mr. Alex. Smith, a progressive farmer from Dungog, regards it as the best wheat he has ever grown. "One ton of it is equal to 3 tons of any other . . . . My dairy herd ate it even in preference to Sunrise oats, both fed at and maturing at the same time." These were his remarks. A similar experience is recorded at Jones' Island, by Mr. A. R. Longworth, another dairy-farmer. Bomen, Thew, Florence, Gresley, Firbank, and Warren, all yielded fairly, Bomen and Florence perhaps standing out, the former owing to its heavy leaf-growth, and the latter for its earliness.

All the combined plots (cereal and legume) yielded heavily. The growth of the legumes was most luxuriant in all cases, and in marked contrast to last season, when the extremely damp season was responsible for their almost total failure.

Instances were brought under the notice of the writer of the very inferior yields obtained from varieties not recommended for the district. At least two farmers with plots adjoining the experiment plots had yields not 25 per cent. as good as the latter, though the crops were sown under similar conditions. Only those varieties should be grown that are recommended.

The Season.

The autumn months were fairly dry. July, August, and September recorded falls that were above the average. The falls were not continuous, but each month was marked by very heavy downpours of short duration. For instance, at Taree in July 436 and 800 points fell on successive days, out of a total of about 13 inches. Again in September 679 points were registered in one day. Conditions such as these were fairly general. Although several plots were spoilt, the absence of wind-storms saved many of the crops from further destruction.

With few exceptions the plots were all sown on alluvial soil, while there was almost a total absence of rust. Bunt was more prevalent than has been noticed in other seasons.

RAINFALL Records.

Months.	Taree.	Sherwood.	Hinton.	Burrapine.
	Points.	Points.	Points.	Points.
March ..	30	3	...	...
April	112	37	...	...
May	474	234	163	734
June	189	152	108	288
July	1,313	871	898	764
August ..	694	309	256	340
September ...	1,070	510	...	1,081
October ...	151	248	...	...

The plots sown in May by Mr. Apps at Miller's Forest, were interfered with by rain; some fine growth resulted, but the weights were not taken. Mr. M. Smith's plots at Paterson, sown in June in a low situation, were flooded, and spoilt.

The Hannam Vale Bureau Plots.

Some very interesting trials were conducted in conjunction with the Department by members of the Hannam Vale Agricultural Bureau. To lend further interest to the trials a contest was arranged amongst the growers—the crop being judged on points. Altogether, nine participated. Unfortunately, owing to the lateness of the year in which the contest was first mooted, a very wide assortment of varieties was not available. Still, the results were exceptionally good, and the interest created was very keen.

—	A. C. McLeod, Manning River.	R. Richardson, Manning River	A. Longworth, Manning River	J. Lambert, Manning River.		J. Ward, Mackay River.	G. Richardson, Upper Manning.	J. P. Mooney, Manning River	F. Brewer, Manning River. Taree Estate.	A. H. Norris, Upper Manning.	H. Flett, Manning River.	T. Pearse, Hinton, Hunter River.	S. J. Dawson, Burrapine, Nambucca.	B. Richardson, Dumaresque Is.	P. McCaffrey, Taree E tate.
Date Sown in 1922 ..	Wheat—7 May. Oats—10 May.	7 May.	25 April.	26 April.	16 May.	24 May.	27 April.	15 April	16 May.	27 May.	9 June.	26 April.	April	1st week June.	3 June.
	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.
Wheats—															
Thew	14 15 0	7 18 2	10 5 3				10 14 1			7 12 2	8 2 3	14 18 2			
Firbank	15 1 0			12 6 0	12 1 1			19 12 0	†	7 10 3			5 17 0	15 18 3	12 4 1
Florence	13 11 1	12 17 0	9 11 2	12 10 0	10 1 2			18 4 1	†	8 19 1	5 3 1		5 8 2	14 0 1	13 7 0
Bomen	12 11 2			10 5 0	15 0 0				9 14 1	7 10 2		11 0 0	7 11 2		17 0 0
Warren	14 5 3	5 9 1				11 7 3				6 3 1	4 13 3		6 18 2		
Currawa	11 14 1		13 11 2							5 9 0					
Gresley	14 5 3	11 10 0				10 19 3			9 0 1	7 12 3	6 12 1	13 7 0			13 11 1
Gresley and Vetches	16 17 0														
College Purple and Thew	11 18 2														
College Purple ..	9 5 3														
Penny		10 12 0													
Clarendon .. .		14 6 1	11 0 0			10 19 3				8 19 0			7 5 2		
Major		16 14 1													
Currawa and Vetches .						11 3 2									
Thew and Vetches						13 15 0							8 11 1		
Thew and Peas ..													7 18 2		
Hard Federation .. .													6 4 1		
Cleveland .. .													6 17 0		
Warden . . .													6 7 0		
Canberra													7 0 0		
Oats—															
Sunrise .. .	*8 4 1	13 16 1		17 11 0	10 0 2	11 7 3	13 11 1			10 4 2		15 6 0	6 15 2		
Sunrise and Peas .		14 7 1				12 15 1				18 0 0					
Sunrise and Vetches .	16 2 3	15 6 1				15 6 1	20 1 1			13 0 0	9 6 0	15 14 0		15 7 0	
Algerian	*7 8 2	12 15 0				11 15 2				10 9 3			5 5 2		
Algerian and Vetches ..		15 8 2				13 15 0									
Algerian and Peas .															
Lachlan															
Guyra	*7 8 2												7 8 2		
Quondong ..	*5 17 0												6 12 3		
Barley—															
Cape . .													4 10 0		

* Sown on poorer land. † Firbank and Florence too far advanced to weigh as green fodder, the ownership of farm changing and causing delay.

Although only small in comparison with other well-known districts, much is made up for by the enthusiasm and progressiveness of the farmers. In this respect they are really an object lesson to other areas. The lands for the most part are fairly rich along the rivulets and creeks and on the higher "brush" country.

In all cases the soil received good cultural preparation, and in several instances fairly heavy applications of fertiliser were given. Algerian oats did particularly well on all the plots, but are rather late from a fodder point of view. Quondong (in the absence of Sunrise) proved rather attractive, yielding well and coming away quickly. A considerable quantity of seed has been ordered for the coming sowing. Florence, Firbank, and Clarendon were the best of the wheats.

HANNAM VALE Agricultural Bureau Results.

—	W. Holden (1).	W. Leaver (2).	J. W. Relman (3).	G. Aitken (4).	N. McLaughlin (5).	W. Ade (6).	W. Bullsworth (7).	O. Convery (8).	H. Hurley (9).
Oats—	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.
Algerian	9 2	18 2	17 2	20 0	19 12	19 5	...	12 2	...
Guyra ...	...	...	15 7	...	...			11 7	13 2
Quondong	...	...	...	15 14	...	12 2	...	...	...
Wheats									
Clarendon ...	6 11	9 8	...	...	...	...	7 14	8 11	...
Florence	7 7	9 0	...	10 2	...	...	8 14	...	...
Penny ...	6 2		...	...	...	...	...	...	...
Major	...	10 14	...	...	...	...	...	...	...
Warren	...	...	10 14	...	...		...	...	...
Thew ...		...	...	17 18	...	...	...	...	...
Currawa	...	...	...	...	8 0	...	8 11	...	...
Gresley	...	...	...	...	8 11	...	...	7 8	...
Firbank ...	...	...	7 11	...	...	7 10	8 0		...
Bomen	...	...	...	...	8 11	7 14	...	...	...

The following are the facts regarding the above plots :—

(1) Alluvial soil impoverished by continuous cropping ; fertilised with superphosphate.

(2) Alluvial river flat land ; good plots ; not fertilised.

(3) Alluvial river flat land ; new ; very good plots ; not fertilised.

(4) Brush land, volcanic, very wet ; magnificent plots ; fertilised with 2 cwt. blood and bone, and 1 cwt. superphosphate.

(5) River flat soil ; fairly good ; no fertiliser.

(6) Alluvial flat soil ; good plots.

(7) Low-lying flat land ; inclined to be sour ; fertilised with superphosphate at one bag per acre

(8) Elevated hill soil ; good plots ; no fertiliser.

(9) River flat soil ; no fertiliser.

THE value of good stud seed, true to variety and type, is gradually being appreciated by the wheat-farmer, who is discovering that such seed usually yields a few more bushels than ordinary bulk seed with which care in selection has not been exercised.—A. H. E. McDONALD, Chief Inspector of Agriculture.

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Canada Thistle (*Cirsium arvense* (L.) Scop., *Carduus arvensis* Robs.).

Botanical Name—Cirsium.—From the Greek, ***kirsion***, a kind of thistle; ***arvense***, belonging to the fields.

Common Names—Canada thistle, creeping thistle, small-flowered thistle, perennial thistle, cursed thistle, corn thistle, green thistle. In New Zealand it is called Canadian or Californian thistle. In America the plant received the name Canada thistle soon after the war of the Revolution, as it was supposed to have been introduced into the United States from Canada, and the name is now in general use both in Canada and the United States

Popular Description.—Hardy perennial herbs with deep creeping root-stocks extending in all directions, and sending up at short intervals numerous erect, slender grooved stems 1 foot to 4 feet high. When new plants are formed, either from seed or from root-stocks, a rosette of dark-green leaves is formed on the ground, similar to the spotted or variegated thistle, but smaller. The leaves are narrowish, deeply indented into very prickly or thorny lobed segments, slightly woolly on the lower and upper surface, and vary from 3 inches to 8 inches in length. The stem leaves are shorter, very spiny, rather distant from each other, and embrace the stem. The flowers are borne singly or in small clusters at or near the top of the stems and branches; they are ½ inch to 1 inch in diameter, pale pink to lilac purple. The seeds are oblong, smooth, grey or pale brown, about ⅛ inch long, slightly contracted into a point at the lower end, and with a slight projection from the centre at the upper end which bear the feathery down or pappus.

Botanical description.—Smooth perennial herbs, with spreading or creeping rootstocks; stem 1 foot to 4 feet high, smooth, corymbosely branched at the top; leaves lanceolate, sessile and deeply pinnatifid, lobes and margins of leaf with spiny teeth; heads small, nearly 1 inch in diameter; bracts appressed, the outer with a broad base, the inner narrow, all with an acute tip, never spiny; flowers purple, diœcious; in staminate plant, flowers exserted with abortive pistil; in pistillate, less so, scarcely exceeding the bracts; long stamens with abortive anthers; tube of corolla 6 lines long; anther tips acute, filaments minutely pubescent; all of the bristles of the pappus plumose; achenes oblong-cylindrical, smooth, brown, apiculate, 3 mm. long.

Where Found.—In cultivation and waste places, the commonest of European and Asiatic thistles, accompanying cultivation in nearly all parts of the world; extending far to the north, though perhaps not quite to the Arctic circle. Abundant in Great Britain, Siberia, Western Asia, India, and Northern Africa; introduced into North America. At the present time it

Canada Thistle (*Cirsium arvense* L. Scop., *Carduus arvensis* Robs.).

is found in nearly all the northern half of the United States; it occurs in Canada from British Columbia to Newfoundland. In New Zealand it is common in the North and South Islands, and is a serious pest in many localities. It was first recorded for Victoria in 1887, and subsequently proclaimed noxious for the whole State.

Its Appearance in New South Wales.—For a number of years Mr. J. H. Maiden, Director Botanic Gardens, realising that it was an old-established agricultural weed of other countries, and that it could only be a matter of time before importation of grain and seeds of various kinds from overseas resulted in the introduction of this pernicious plant into New South Wales, warned farmers to be constantly on the lookout for it. That surmise has proved correct, for early in January of this year, the shire clerk, Dalgety Shire, Berridale, forwarded it for determination. From inquiries made by Mr. D. J. C. Rendle, Shire Clerk, "it would appear that the seed of Canada thistle was brought to Jindabyne some six or seven years ago in seed oats obtained from a local business house, but it is not possible to find out now where the oats were grown. So far it has not spread much, and one or two patches not far apart have shown that cutting down with a mowing machine checks the growth to an appreciable extent. Stock refuse to touch it even when short of other food."

A Serious Pest.

Here is what the Americans have to say about it:—

In all the history of weeds in America none has been more complained of than the Canada thistle. A century ago it was regarded by the farmers of New England as the greatest pest of their fields. When the sons of these farmers moved west the Canada thistle went with them. It grows vigorously, sometimes spreads rapidly, and is always difficult to kill by ordinary cultivation. It forms dense patches, sometimes to the complete exclusion of other plants, and its abundant sharp spines makes it disagreeable to handle. To these characters are due its traditional reputation in the North-eastern United States as the worst of all weeds.—Circular No. 27 (Revised), U.S. Department of Agriculture.

In 1896 the United States Department of Agriculture published a Bulletin, "Legislation against Weeds," compiling the Acts on the Statute-book of the several States and recommending a general State weed-law, sufficiently elastic to fit the varying floras, soil, and climate. Therein it was shown that all but three of the States having laws for the suppression of weeds make it an offence for their citizens to permit the Canada thistle to mature and scatter its seeds. Penalties are also provided in the case of seedmen who sell grain, grass, or clover seed contaminated by its presence—but the thistle marches on, bidding defiance in every prickle to such attempts at its extermination. The laws are very good but enforcement is neglected.

The jointed, horizontal rootstocks are the most obnoxious part of the plant; round, slender, like tough white whipcords, lying so deep in the ground as to be always sure of moisture, they creep in every direction for rods sending up new plants at short intervals; if broken and dragged about by farm implements the pieces grow, so that ordinary cultivation but serves to spread the pest.—Ada Georgia, in "Manual of Weeds," page 514.

If proper precautions are taken Canada thistle need never get a foothold in New South Wales. The prevention of any top growth will eventually destroy it altogether.

Canada thistle, like prickly-pear, takes possession of the best land.

Methods of Eradication.

The following methods of eradication are recommended by Albert A. Hansen in "Farmers' Bulletin," No. 1002, U.S. Department of Agriculture :—

In the eradication of the Canada thistle there are many factors to consider, one of the most important of which is the weather. The weed is much easier to eradicate during droughts than during wet weather. The operation of ploughing, harrowing, and cultivating directed against the thistle should never be undertaken when the land is wet. Control methods for the Canada thistle should aim at complete eradication ; if only a few plants survive they are usually sufficient to cause serious reinfestations in a comparatively short time. To secure complete eradication the underground parts must be completely killed, since it is principally by these that the pest lives over from year to year. The most practical method of exterminating these underground parts is to starve them out by frequently destroying all the top growth of the plant. Since plants can assimilate food only by the aid of green leaves the frequent cutting of the tops uses up food stored in the fleshy roots.

The importance of eradicating the Canada thistle on small areas can hardly be overestimated, since the pest spreads readily and a small patch may be the direct cause of infesting an entire farm almost before the farmer is aware of the presence of the weed.

There are several methods by which small area infestations may be eradicated, the commonest and most practical of which is the frequent cutting of the green growth by means of a hoe, spud, or some other cutting instrument. It is desirable to sever the stems a few inches below the surface of the ground.

This will cause the eventual starvation of the weed, but perseverance is needed to ensure success. If the patch is very small it is sometimes practical to dig out the plants, roots and all.

Smothering is practical on limited areas. Cover the infested spots with tar, building, or some other kind of heavy paper, which should be laid with overlapping edges, well weighted down with earth or stones, so that no light can penetrate. At least an entire season will be necessary for success. Small patches may be eradicated by covering them with at least 18 inches of manure for a minimum period of a year.

The use of chemical plant poisons is practicable on small areas. The application of crude carbolic acid, hot brine, sulphuric acid, kerosene, or of strong solutions of caustic soda, or arsenite of soda to the newly-cut surfaces has been successful, but the expense is heavy. Arsenite of soda is a deadly poison, and must not be used in places to which live stock have access. Crude carbolic acid and kerosene are best applied by means of an ordinary machinists' oil-can. Salt persistently applied to the newly-cut surfaces will eradicate thistles.

Canada thistles growing in waste places and along fence rows, railways, and roadways, should never be allowed to mature seed, and thus act as a constant menace to surrounding lands. Such infestations should be eradicated. If the eradification is not complete the thistles should be mowed at least twice a year to prevent seeding.

Clean cultivation with a crop applicable on large areas.—This method has the advantage of killing the weeds without losing the use of the land while so doing.

In a well-prepared seed-bed (field) plant a cultivated crop, such as maize, using the check row system, if practicable. Cultivate thoroughly, in order to prevent the development of thistle leaves. The shoots must be cut off no less than six or eight times during the season if complete success is to be attained. It will be necessary to go through the crop occasionally with a hand hoe in order to clean out the plants growing so close to the maize that they escape the cultivator. The best implement for cultivation is the sweep or knife type of cultivator. The shovel and tooth types of harrows and cultivators, so commonly used, are not so efficient, since they allow much of the top growth of the thistles to slip through. Special sweep or knife-cutting implements may be used, or separate sweeps may be purchased and attached to the cultivator in place of the shovels. Sweeps are adapted to loose, friable soils only ; their use should not be attempted on cloddy or stony soils. After it becomes impracticable to cultivate longer, any thistle tops which appear should be cut back with a hoe until frost.

A single season of careful, painstaking work will frequently serve to exterminate the thistle; less time is really required than is generally believed, provided the work is thoroughly done.

The following season another cultivated crop should ensure the success of the plan.

Summer fallowing followed by a Cultivated Crop.—Like the last plan of eradication, summer fallowing, followed by a cultivated crop, keeps in check the top growth and starves the root system, thereby eradicating the pest. The plan is well suited to large areas. Just previous to the blossoming of the thistle, which is the stage at which the plant is most easily destroyed, plough shallow. During the remainder of the growing season cultivate with a disc-harrow or with sweeps at intervals often enough to prevent a maximum of 3 inches of thistle growth at any time. Continue this practice until fall. If the thistle roots are sufficiently near the surface plough deep enough to expose them to the effects of winter frosts. The following spring plant the land to a cultivated crop, such as corn, and give careful cultivation to see that no thistle tops survive. The cultivated crop will enable one to destroy any thistles that may appear. The thistles should be entirely eradicated when the crop is matured.

Eradication in Pastures.—Normally few, if any, animals will feed upon Canada thistle, although if no other forage is available sheep and goats may be forced to graze the weed. The salting of numerous small thistle plants will greatly facilitate eradication, since it will aid in inducing the animals to overcome their dislike for the prickly pest. Close grazing will have the effect of starving out the underground parts.

THE LURE OF THE WHEAT.

WOULD you feel satisfied with your prospects if you could be certain that in, say, fifteen years' time, you would have, after paying your way, a property worth £6,000? Or to put it another way, would you think you had done well if you were this much better off than you were fifteen years ago? This is the value of a fairly large wheat farm, well improved and with a first-class equipment, and there are many wheat-farmers who have acquired farms of this value in that time. With a moderate amount of capital, energy and common sense, and some experience the same results can again be achieved.

While wheat-growing is profitable, it is also, to most men an agreeable life, being free from unremitting toil. All machinery for the cultivation of the land is now of large size; the plough behind which the farmer wearily trudged all day is a thing of the past. The great harvesting machines, too, only require the guiding hand of the master, who is thus freed from all the heavy work formerly associated with the ingathering. The wheat-grower of to-day has an occupation in which is combined that of a trained mechanic, that of a business man for the administration of his farm, and that of a professional man for the conduct of his farming operations. Is it any wonder that wheat-growing has an appeal that few other occupations have? —A. H. E. McDONALD, Chief Inspector of Agriculture.

A BOOK ON PRUNING.

"PRUNING" is the title of a book published by the Department that will shortly be of seasonable significance to the orchardist. Containing almost 200 pages of well illustrated matter, the publication is designed to convey to the practical fruitgrower just the information on this important subject that he needs. It literally teaches the art by picture and can be taken into the field and compared with the tree itself as a proper guide. Copies are obtainable from the Under Secretary and Director, Department of Agriculture, or from the Government Printer, Phillip-street, Sydney, for 3s. 3d., post free.

The Forthcoming Bureau State Conference.

A tentative programme has been drawn up for the State Conference of branches of the Agricultural Bureau which is to be held at Hawkesbury Agricultural College from 18th to 22nd June, inclusive. The first day, 18th June, will be spent in Sydney, and visits will be arranged—in the morning either to the abattoirs or Vicars' woollen mills, and in the afternoon to the wheat silos or the Amalgamated Wireless establishment, at delegates' option On 19th June delegates will leave by the 8.56 a.m. train for Richmond, and at noon a luncheon will be held, and speeches delivered by the Governor and the Principal of the College. At 2 o'clock the Conference will be opened by the Governor, and addresses will be delivered by the President (Sir Joseph Carruthers) and Mr. Kelly, President of the Advisory Board of the Agricultural Department of South Australia. Discussion on motions will follow until 5 o'clock. The 20th June will be occupied by addresses and a debate on rural finance, and on the following day a "free parliament" will be held for discussion of the various motions that may be submitted. On the closing day the debate will open early if necessary to complete the business on the paper, and will continue as long as may be needed, or up to 3 o'clock in the afternoon.

Cuban Experiments in the Propagation of Sugar Cane.

In a recent issue of the monthly review published by the International Institute of Agriculture, Rome, mention is made of tests of a new method of propagating sugar cane, as carried out at the Agricultural Station of Cuba by M. Salvino, and described by him in *Revista de Agricultura, Comercio, y Trabajo,* Havana. The method was recommended for India by Kulkarni, and consists of cutting the cane into sets of three nodes (taking them from a little above the two last nodes), and of removing all the eye-buds except the one of the middle node. The set should be planted so that the eye-bud points upwards; in this way a much more vigorous tuft of sugar-canes is obtained than if the eye-bud points downwards. The tests gave results that were very satisfactory.

This system can be improved, says the publication quoted, by adopting the practice of letting the sets bud before planting them out, thus giving an opportunity for choosing the most vigorous shoots.

A frame of bamboo is erected at a convenient height (say 3 feet) above the ground, and upon it is spread a thin layer of straw soaked with dung mixed with a little water. The sets are first dipped in a mixture of dung and water and then piled up roughly on the frame, so that they form heaps, the sets crossing each other in every direction, and thus allowing a free circulation of air. The small heaps are in their turn covered with a layer of straw soaked as before in a mixture of dung, the whole being kept moist by repeated and careful watering.

The increased yield fully compensates for the larger number of workers required. If lack of labour makes it impossible for the process to be carried out on a large scale, only the cuttings destined for the plantations reserved for propagation may be thus treated.

The Problem of City Milk Supply.

SYDNEY AND COPENHAGEN COMPARED.

C. PEDERSEN, Senior Dairy Instructor.

A GREAT deal has been said and written about the Sydney milk supply—its quality, price, &c., and perhaps with good reason from the point of view of the public. The question is, where does the fault lie, and what should be done to put the milk supply on a footing worthy of a big city? New South Wales has succeeded in placing the dairy industry on a very sound basis, but the milk trade has not received the amount of consideration that has been given to the manufacturing section of the industry.

During my recent trip to Denmark and other countries I took particular notice, where possible, of the production and handling of milk for human consumption, and was impressed with the fact that we can learn much from the system now in vogue in Copenhagen, and that some features of their system could be applied here with advantage.

Copenhagen and suburbs, and Sydney and suburbs, are cities of about the same size and population, and the demand for milk is about the same. In the Danish city the bulk of the milk is handled by five companies. These companies each operate in their own zones, there being only a little over-lapping here and there. One of these was established more than fifty years ago, and has done much to put the system in its present perfect order, as well as to educate farmers in the handling and treatment of their product.

Owing to the land around Copenhagen being rich and very productive, it is not necessary to go such long distances into the country as we have to, and consequently the milk arrives at the head depôt in much better order and condition than is the case with the Sydney supply. The conditions under which the milk is produced on the farms are almost as perfect as can be, the care with which the work is done being a pleasure to watch.

The companies lay down rules for the guidance of farmers, and insist upon compliance with them. They provide that all persons engaged in milking must be clean in their person and habits. Before milking commences they must change their outer clothing and put on overalls that are made for the purpose from white linen—sometimes from butcher blue—and that are always clean. Next the cows must be carefully brushed down, so that no dust can fall from their bodies into the milk, and the milkers' hands must also be thoroughly clean, and kept so during the whole milking period. Cleanliness seems to come to the Danish farmer as second nature. It has been handed down from generations, and now seems part of his existence.

After being drawn the milk is strained, a filter cloth being placed in the bottom of the strainer, and is then passed over a cooler through which iced

water is running. From there the milk is run into a transport can, which, when full, is placed in a concrete basin containing cold water that comes up to the neck of the can. In summer crushed ice, which was collected and carted from streams and ponds the previous winter and stored in houses that contain 30 and 40 tons, is packed in between the cans to cool the milk further, and keep it so until it can be sent to market. Under these conditions the milk arrives at the depôt in a perfectly sweet condition. The facts provoke the reflection that if, in a cool country like Denmark, the artificial preservation of low temperatures is so highly esteemed, how much more important is it in New South Wales! Ice is certainly not available, but the mechanical cooler and thorough aeration should be regularly employed by every producer.

The companies employ veterinary surgeons to inspect the stock, and inspectors (called health inspectors) are appointed to inspect for cleanliness and to give advice. So long as a farmer sends in his milk in good condition no inspector will go near him, but if his milk arrives at all faulty the inspector soon appears on the scene. So keen are the farmers about maintaining their own reputations and the quality of their product that it is considered a reflection upon him if the inspector visits the place of any one of them, and he receives more jibes from his neighbours about the incident—and for months after—than from the inspector himself.

After the milk arrives at the head depôt it is weighed, sampled, and graded, the grading being done by women. Samples are taken at regular intervals to be tested for cleanliness as well as for solids and fat. The best milk is selected for baby milk, passed through a purifier, and then over a cooler, from which it is bottled ready for issue. The other part of the milk is pasteurised, cooled and bottled, and then sent on to what are called the milk shops. These shops are fine establishments, large and roomy, the whole of the inside being painted with white enamel paint, and the people serving in them being wholly dressed in white. The shops also handle cream in bottles, butter, and eggs. They are supplied with large cool rooms, where the milk, cream, and butter are kept.

The milk companies separate a portion of their milk to get the amount of cream needed for their customers. The Danes are heavy coffee drinkers, and with the coffee they must have cream. A great proportion ot the cream is consumed in the city of Copenhagen. The cream is pasteurised and homogenised (a new process), to make it uniform and to ensure that it will keep, for it is claimed that the process increases the keeping quality. It certainly makes a beautiful cream, even in texture. Though it may stand in bottles for several days it will still be uniform. The process of homogenising consists of passing the cream through a machine in which it is subjected to a pressure of about 3,000 lb. per square inch. It should be a very useful process in Australia, as it would enable fresh milk and cream to be sent from the coast to inland places where cow's milk is hard to procure.

Very little milk is delivered at the houses in Copenhagen. Most people send to the milk shops for their requirements—it may be a small bottle or a large

one, but having been handled in the way described, the bottled milk will easily keep sweet for two days (even in the summer), and regular deliveries are therefore unnecessary. Hotels and restaurants using large quantities of milk are supplied with their requirements in cans from the head depôts, instead of with the bottles.

If a comparison be made with the treatment accorded milk that is to be used in Sydney, it is much to the advantage of the Copenhagen method.

In our milk-supplying district, though a hotter country and therefore a more trying one for the product, it is not drawn with the same care; it is received at the depôts, where it is pasteurised and chilled, sometimes is pumped long distances into vats, in which it may be held for many hours before being run into large tanks on the railway-trucks, and so railed to Sydney. In the city it is again pumped into other vats and where necessary pasteurised, cooled and agitated, and run into small tanks or vats in which it is transported to the suburban depôts, where it is again handled before being delivered to the public. The nearer suburbs, of course, are served by carts from the main depôts in the city.

This treatment is much too rough for a product of such delicate qualities as milk, while the time that elapses between the milking and the delivery to the consumer is so great as in itself to allow serious depreciation in the constituents of the milk. The addition to the cost occasioned by the method makes a most important article of food exceedingly dear.

If the public of Sydney are to have good fresh milk at a reasonable price the first move that the Danish system suggests is that all the milk depôts in the country should be equipped with milk-bottling plants, and all milk not used in bulk for hotels and restaurants sent to the city in refrigerating cars and immediately taken to the depôt. The milk would then arrive in Sydney in a cool condition, and could be taken delivery of at the railway yard by carts that could deliver it to their customers. One delivery per day would then be sufficient, while the milk would be better in quality and probably cheaper.

Leaflets on Diseases of Plants.

In the successful production of any crop, a knowledge of the diseases to which it is liable and of the means by which such diseases may be treated and prevented is of considerable significance. Inevitably, therefore, an important branch of the Department's work for the farmer has been research in relation to plant diseases generally, and in order that the information collected under this heading may be made available in the most compact and economical form, the Department has recently instituted a special series of plant diseases leaflets.

Among the diseases so far included, special attention has been given to fruit, but wheat and tobacco are also dealt with, and the scope of the series is being steadily enlarged. The list at present comprises some thirty-three leaflets, and such of these as will be useful to him in his work will be forwarded without charge to any farmer on application to the Under Secretary and Director, Department of Agriculture, Sydney.

Tick Control Problems.

The Tweed Quarantine Area.

C. J. SANDERSON, Chairman, Tick Board of Control.*

In this area ticks had been steadily increasing for years, until more than 50 per cent. of the farms were infested. To continue the system of dealing with the tick which had been in operation since 1906 held out no prospect of success whatever, and the Board of Control decided to adopt the method of compulsory treatment of all stock in the Tweed quarantine for a period at intervals of fourteen days.

The Board was led to take this step because it found that ticks had existed on the Tweed since 1906, and in spite of the measures that had been put in operation to check the pest it had steadily progressed, as the following table of official records shows:—

Farms infested to June,	1916	 236
" " "	1917	 356
" " "	1919	 381
" " "	1920	 599
" " "	1921	 674

The figures for the year 1918 are not given, owing to the fact that compulsory dipping was in force during portion of the year, and examinations for ticks were not made.

From January, 1920, to the end of 1921 every effort was made to carry out the work with the measures in operation when the Board took over control, but, although the staff was increased and more effective supervision of the work was arranged for, the result was the same, and infestations increased in numbers. It is true that Mr. Inspector Glennie, in charge of the Tweed, was able to report at the end of the period June, 1920, to 1921, that no farm not previously infested had been discovered, but in spite of that the total number of farms infested had increased from the previous twelve months. It became plain—both from the experience of the previous administration and of the Tick Board—that the measures adopted on the Tweed were useless to eradicate the tick.

Why the Board Acted.

The Board came to the conclusion that, while the system of treating only those holdings on which ticks were found every fourteen to eighteen days, and inspecting so-called clean holdings every three weeks had the effect (at a prohibitive cost) of preventing loss to the farmer from tick-worry, eradication was impossible. It was, therefore, clearly bad administration

* Extracted from the annual report of the Tick Board of Control for year ended 30th June, 1922.

to persist longer in a course that would involve a considerable annual expenditure without achieving the desired result, and it was necessary for more effective measures to be adopted. The Board consequently decided to put into operation a scheme which eliminated many of the factors which had previously made success impossible.

From the standpoint of complete eradication of the tick, it is unfortunate that Government control had been sufficiently effective to prevent loss from ticks, as the farmers consequently had less incentive to get rid of the pest than they would if ticks had caused them monetary loss.

Out of 1,231 farms in the Tweed quarantine, roughly 900 have been at one time or another infested, and the records show that the vast majority of these farms have been infested more than once, and some have been cleaned and re-infested as many as eight times. Clearly, a system that allowed such results had to be replaced with something more effective if any finality was to be reached. Many of these infestations and re-infestations were due to illegal movements of stock, broken fences, which allowed stock to both enter and leave a holding, &c., and could be avoided if farmers would obey the law that requires them to keep all stock in a securely enclosed holding, and only to move them in accordance with certain regulations, but even if the law, as it stands at present, had been kept, it would not have prevented ticks spreading from farm to farm.

The divisions between farms are almost invariably barbed wire fences, and these cannot prevent the movements of ticks from one farm to another; hence it is commonly found that after a farm has been found infested, the adjoining farms likewise are discovered to harbour ticks. It has been found that A has infested B, and after A has been cleansed it has in turn been re-infested from B. Again, there is another means of carrying ticks from farm to farm, which is unavoidable—we refer to eggs that are washed from hill farms on to the lower lands by heavy rains, creeks running through several holdings, and by floods. Last, but by no means least, the Board found that the powers at its disposal for dealing with straying stock were, even when assisted by the Tweed Shire Council, totally inadequate, and decided that the only means of dealing with such stock would be short-interval dippings.

Tweed Farmers' Objections, and Replies Thereto.

The Tweed farmers objected to the Board's eradication scheme on the following grounds:—

1. That dipping every fourteen days would ruin the dairying industry.
2. That tick eradication on the Tweed was impossible, owing to its proximity to Queensland.
3. That the Tweed was being selected to experiment on.
4. That eradication was unnecessary, but that a system of intelligent prevention should be adopted.
5. That spraying in lieu of dipping should be adopted.
6. That clean herds should not be treated.

It will be of advantage, perhaps, to reply to these various objections.

In reply to (1), it may be said that, if it could have been supported by evidence, it would by itself be quite sufficient to condemn the Board's scheme as impracticable, but no such evidence was forthcoming. In the first place, continuous dipping of cattle in large areas at such an interval had not been tried in this country. The officials of the Tick Department could produce plenty of evidence that dipping at slightly longer intervals did no harm if properly carried out, but it was necessary to go to America and Africa for direct evidence of the effects of fourteen-day dipping. The annual report of the Bureau of Animal Industry (U.S.A.) shows that dipping at this interval has gone on for years on an enormous scale, and, as the Americans are a practical people, it can hardly be supposed that they would continue to carry on this system had it produced bad results.

Direct evidence on this point can be obtained from the Cowley Commission that visited America in 1912, and the Board holds a letter from Mr. Pound, Government Bacteriologist to the Queensland Government, and a member of that Commission, in which he states that the Commission had seen valuable stud herds of dairy cattle, including the champion Jersey dairy cow, subjected to dipping at fourteen-day intervals.

The report of Professor Gilruth, F.R.C.V.S., who visited America for the Federal Government in 1919 to report on the methods adopted in America for dealing with the tick, states on page 3 of the report that in one month 6,267,475 cattle went through 34,213 dips at fourteen-day intervals. This fortnightly dipping takes place regularly from March to December, and (so the report states) the utmost care is taken that no animal, even the youngest, is missed.

Further, the Board has evidence at its disposal from South Africa that dipping at seven, and even five-day intervals is carried out in wholesale fashion all the year round, with the best results.

Mr. Glennie, Inspector in charge of the Tweed area, states that the opposition to the proposal was certainly started by farmers with practically no experience of dipping at all, and, at the big meetings, men who knew better were "howled" down if they dared to say so.

The second objection was made a very strong point, and anyone not acquainted with the facts might conclude that the contention was a sound one. Such is far from being the case. The tick in Queensland adjoining the quarantine line is infected with the organism of redwater, and the progeny of such ticks are similarly affected. Should, therefore, ticks from Queensland cross the border and attach themselves to cattle in New South Wales, an outbreak of redwater is inevitable. The cattle in New South Wales are highly susceptible to the disease, as is shown by the mortality attending any stock crossing into Queensland, but, as only five outbreaks of redwater have occurred in the quarantines since the year 1906, it is proof positive that the arrangements made by the Government to keep the Queensland tick from invading New South Wales are very effective, and the danger from this source is of the slightest. It was also contended that

ticks might come into the Tweed area from the south, but, as this region has been practically cleaned, while active supervision is continued by the Government there is practically no possibility of this happening.

The statement that the Tweed was being selected to experiment on was quite untrue. The system of eradication the Board wished to adopt has been successful in America in cleansing, from the year 1906 to 1919, over half a million square miles of tick-infested country.

As to the fourth objection, the Board can say that dipping is the most intelligent form of prevention that can be suggested, but the method should be continued until eradication is complete.

Practically every authority that could be quoted agrees that spraying is not so effective as dipping. Our own experience is that it is not reliable, it is wasteful of time and of dip mixture, and, moreover, is very hard on the staff who have to carry it out. It is impossible to check the strength of medicament used, and when large numbers are being sprayed mistakes may, and probably do, occur. As all the mixture is used it is impossible to say what has happened. When cattle are dipped, the strength of the dip mixture used is known with certainty; cattle are not knocked about in crushes as they are when sprayed; they are treated quickly, and can get back into the paddock to feed in one quarter of the time expended when spraying is adopted. We quote from a report of the United States Bureau of Animal Industry on this question as follows:—

SPRAYING AND DIPPING.

P. 281.—Spraying is not practical except in the case of very small herds, unless a spraying machine is used. Spraying machines, however, have proved less satisfactory than dipping vats, and it is therefore preferable to use a dipping vat whenever more cattle are to be treated than it is practicable to treat by means of hand spray pumps. Hand spraying is not only more tedious than dipping, but it is also far less efficacious, as there is not the same certainty of getting a thorough application of the dip, even when the greatest care is used. Consequently, the dipping vat is much more reliable than the spray pump. It is also more economical whenever more than a very few animals are to be treated. Even when dipping vats are used, it is necessary to have them at least 40 feet in length at surface. If a shorter bath is used, the cattle should be held in the bath at least 15 seconds, better, half a minute, otherwise they are liable to get through the bath without being thoroughly wet to the skin, particularly if the hair is long. A steep slide at the entrance of the vat is desirable, in order to ensure a plunge which will carry the cattle entirely under the surface of the bath.

If this is necessary with a dip, it will be seen how useless it is to attempt to rid cattle of ticks as a general measure by spraying. When cattle have long hair and perhaps a certain amount of mud on them it is quite impossible to wet them to the skin by use of a hand spray pump.

To agree to the farmers' wishes to allow spraying in lieu of dipping would mean that the staff on the Tweed would need to be practically doubled, vastly increasing both the cost of treatment and the chance of failure.

Replying to the sixth objection, it can be said that in an area like the Tweed quarantine, where more than 50 per cent. of the farms are infested, to agree to this suggestion is impossible. As a practical means of dealing with such heavily infested country, it is absolutely necessary to treat every hoof in it, *otherwise failure is certain.*

The Royal Commissioner, Mr. Fletcher, in his report, page 11, under the heading "Bangalow-Lismore Section and Richmond Area (*b*)," recognised the necessity of treating all holdings adjoining an infested and quarantined farm, but this would not be sufficient on the Tweed. While the known infested farms are being treated, the clean farms are, in many cases, becoming infested also. Inspection is of very little value as a practical means of dealing with this, and a regularly inspected farm may be tick-infested and escape detection for some little time, as, unless ticks are in the engorged stage, they are very difficult to detect, especially on a restive beast. Inspections only take place every three weeks, and in the case of a crop of ticks ten days old on a beast being missed—which, as the ticks are only about the size of a pin's head, easily occurs—they would have reached the engorged stage and dropped off before the next inspection, and the inspector would again find nothing.

The only sensible way to deal with the Tweed Area is to treat all the cattle in it at the one time. The infested holdings require treatment to kill ticks, while the clean holdings require treatment to prevent them becoming infested. This is intelligent prevention properly applied. The Americans, who succeed where we fail, adopt this principle in a way that it would be difficult to get Australia to agree to.

Professor Gilruth, in his report, page 3, states that in one month 726,730 herds, comprising 6,267,475 head of cattle, were dipped; of these, 54,443 herds and 519,599 cattle respectively were found actually infested with ticks. This represents only one herd in thirteen infested, whereas, on the Tweed, in the year 1920-21 the proportion was one in two. If the United States finds it necessary to treat the whole of the cattle in an area where they have only one herd in thirteen infested, how much more is it necessary for New South Wales to treat every head of stock on the Tweed, where one herd in two is infested?

The Board's Attitude.

The Board wishes to state that the scheme they desired to employ for tick eradication on the Tweed was founded on the knowledge of the life-cycle of the tick, and of the meteorological and local conditions generally. It represented the minimum requirements for success.

In any conference with the Tweed farmers, it must not be forgotten that they have, by an overwhelming majority, definitely decided that eradication of the tick is not their desire. The Tweed quarantine represents less than one-fifth of the whole area at present infested.

The Lismore-Bangalow, Bonalbo-Woodenbong quarantines, which represent, roughly, three-fifths of the total quarantine area, and include 4,163 holdings, at the end of April, 1922, had only forty-eight holdings on which ticks were active. At the same period last year there were, roughly, 150 farms infested in these sections.

There may be set-backs in this big area, due to the law being broken by farmers, but there can be no question that success here is quite possible, and, indeed, practically certain.

One of the questions for consideration in connection with the Tweed is—Shall this comparatively small area, of roughly 1,200 holdings, be allowed to remain a menace to the remainder of the State?

The Board is quite convinced that, while sections of the farming population will co-operate in the work of eradication, a large number will not do so. Such is the state of affairs on the Tweed that it would be impossible for any representative of the farmers to guarantee that fifty men would agree to any arrangement he might make on their behalf. In this section every man is a law unto himself, and, as the Tick Board is convinced that no local individual or body has any chance of controlling the actions of the Tweed farmers, it is useless to expect any notable increase of co-operation in tick eradication as a result of any conference that may be held.

Before any serious attempts can be made to deal with the Tweed quarantine or any other area in which a large section of the farming community puts itself in opposition to the Tick Act, it will be necessary to make considerable alterations in both the Act and the regulations made under the Act. The powers conferred under the Act are inadequate for the purpose of eradicating the tick or overcoming the opposition. The defects of the measure are well known, and the failure to obtain convictions in many prosecutions has shown offenders that it is perfectly safe, in certain matters at least, to openly defy the body charged with its administration. As an example of the futility of the Act and regulations, it may be stated that one family in the area boasts that they have been prosecuted forty-seven times, and that the Department has failed to obtain a conviction on thirty-nine occasions.

Withdrawal of Continuous Dipping.

The farmers of the Tweed area, having made it quite plain that they would not accept the Board's scheme for eradicating the tick, a special meeting of the Board was held to consider the situation, at which the following resolutions were passed:—

1. That owing to the widespread and determined opposition to the proposals for tick eradication in the Tweed Quarantine Area, the Tick Board of Control regards their enforcement as impracticable, and recommends the scheme be withdrawn for the present.

2. That, being convinced treatment for eradication is the only correct way of dealing with the tick, the Board cannot identify itself with any other method in this area.

3. It is recommended for the consideration of the Minister for Agriculture that the Tweed Quarantine Area be retained as a quarantine, and the Tick Board of Control deal with it under the following conditions, viz.:—

(*a*) That a rigid guard be established on all its boundaries to prevent the introduction of pathogenic ticks from Queensland; also to prevent extension of the pest to the south of the Tweed Quarantine.

(*b*) That the Board have control of any outbreak of tick fever that may occur in the Tweed Quarantine, as is provided for in the amended regulations now being printed.

(c) That the Board have control of all stock, grass seed, hides, &c., entering or leaving the area.

(d) That, pending consideration and decision by the Minister of the Board's suggestions for dealing with the Tweed area, that area will continue to be treated under the Stock Diseases (Tick) Act.

At the present moment the farmers of the Tweed are dealing with control of the tick inside the quarantine boundaries, the Tick Board only retaining sufficient staff on the Tweed to arrange for inspection and treatment of cattle, hides, and grass seed leaving the area, and guarding the boundaries.

While the abandoning of eradication work is to be deplored, it is difficult to see what other course was open to the Government in face of the attitude of the Tweed farmers.

It may be as well to point out that on the Northern rivers of New South Wales the most favourable conditions are present for tick-life. Owing to the warm temperature and moisture which exist all the year round, the process of egg-laying and hatching is never interrupted, although it is, of course, slower in the winter season. While every farm is stocked up to its full carrying capacity, and the majority are overstocked, the number of ticks increase in direct proportion to the number of hosts found on a farm. Thus, the more stock there are the more ticks will increase, and under such conditions they may become so troublesome that, quite apart from their role as carriers of disease, they do an enormous amount of damage by the withdrawal of blood from the stock, and by the irritation they cause. A heavy infestation will cause death from acute anæmia, the animal being bled white by ticks.

So far the stockowners of the Tweed have done little, and in many cases nothing, to combat the pest, but they will have to tackle the problem during the next year if disaster is to be averted. There is no hope of eradication in this area until the people realise that the work can only be successfully carried out by the united effort of the Government and the stockowners. Each is powerless without the other, but, working together, the pest can be quickly suppressed.

Methods by which Ticks are Spread.

In seeking a remedy for any disease, it is essential to find the cause of it, and, the cause being removed, the disease will disappear. The cause of ticks spreading is due to stockowners breaking the law, and the remedy is to rigidly enforce the Tick Act and compel obedience to the law. In plain language, ticks are spread because many stockowners deliberately break the law.

Abundant proof exists that ticks can be eradicated from any area provided all stock in that area can be treated at suitable intervals. The Tick Act and regulations provide the machinery for doing this, and any evasion of the law should be followed by heavy penalties. Stockowners who have been, and still are, assisting the Department in trying to get rid of ticks will be greatly encouraged in their efforts if they see that people who break the law are properly dealt with.

Experiments with Arsenical Dipping Fluids.

[Continued from page 115.]

LIONEL COHEN, F.C.S., Chemist, Tick Board of Control.

The Third Experiment.

In order to check the results of the 1917 experiment, a third series of trials was conducted, also at Oxenford, in March, 1920. The dipping-bath at Helen's Vale was cleaned out, measured, filled to a depth of 6 ft. 2 in. with water, and 5 gallons concentrate added, as well as 2½ gallons emulsion. Three infested cows were then dipped and a sample of fluid taken for analysis. A further quantity of concentrate and emulsion was then added, three more cows dipped, and so on, until twelve animals in all had been dipped at various strengths, as shown below :—

Cattle Branded.	Strength of Bath.
1, 2, and 3	·085 per cent. As_2O_3 = 3·4 lb. per 400 gallons.
4, 5, and 6	·117 " " = 4·7 lb. " "
7, 8, and 9	·140 " " = 5·6 lb. " "
10, 11, and 12 ...	·176 " " = 7·0 lb. " "

Notes on observations on these animals are given hereunder :—

Yellow Cow, branded No. 1.—*Dipped 4th March, 3·4 lb. arsenious oxide per 400 gallons.* Clean cow, no ticks under legs, lightly infested on escutcheon. One mature female marked. 5th March : Apparently no effect. Marked tick disappeared. Two semi-engorged adults marked in front of udder. 6th March : Badly affected. Marked ticks gone. 7th March : Two apparently healthy new-fledged adults marked. 8th March : Marked ticks sick or dead, many live males left.

Baldy Cow, branded No. 2.—*Treatment same as No. 1.* Heavily infested with ticks in all stages on udder and under flanks. Many mature front of udder. Fore parts clean. 5th March : Young ticks only slightly affected ; ticks on udder affected. 6th March : Two marked on base tail apparently unaffected ; otherwise all affected. 7th March : Numbers of females of all stages still alive on escutcheon. 8th March : Yesterday's grown but discoloured. Two engorged females apparently well.

Brindle Cow, branded No. 3.—*Treatment same as No. 1.* Very lightly infested. Scabby on escutcheon, slightly pustular. One mature female marked. 5th March : Marked tick affected. 6th March : All nymphs apparently dead, marked tick dead. 7th March : Apparently no sign of life, scabbiness clearing up well. 8th March : Only one female left alive.

Spotted Cow, branded No. 4.—*Dipped 4th March, 4·7 lb. arsenious oxide per 400 gallons.* Heavily infested on escutcheon and back of udder. Many nymphs on brisket. Mature female marked on udder. 5th March : Slight effect. Marked tick apparently unaffected. 6th March : Marked tick gone, mostly badly affected except five semi-engorged on escutcheon. Most nymphs on brisket dried off, mature female marked on brisket. 7th March : Some of doubtful appearance. One marked on belly near udder. 8th March : Marked tick dead, rest very sick or dead.

ROAN COW, BRANDED NO. 5.—*Treatment same as No.* 4. Fairly heavily infested on udder. 5th March: All affected. 6th March: All badly affected. 7th March: No sign of living ticks. 8th March: No sign of living ticks.

SPOTTED COW, ONE HORN, BRANDED NO. 6.—*Treatment same as No.* 4 Clean, except for moderate infestation in all stages on escutcheon and back of udder. Head imperfectly submerged. 5th March: Affected. 6th March: Two adults on right leg marked doubtful, rest pretty sick. 7th March: Marked ticks gone, one marked on left thigh. No sign of fresh ticks. 8th March: Marked tick gone. Two had emerged from moult, but were dying, or dead.

SPOTTED AYRSHIRE COW, BRANDED NO. 7.—*Dipped 4th March, 5·6 lb. arsenious oxide per 400 gallons.* Grossly infested on udder and inside legs. Marked a bunch of twelve engorged females on front of udder ready to drop off. 5th March: Strongly affected, marked bunch puffy. 6th March: All badly affected, except two on right flank, marked. 7th March: Marked ticks dead, one live female on escutcheon marked. No sign of newly-emerged adults. 8th March: Very effective. Two healthy, one sickly, left.

BLACK JERSEY COW, BRANDED NO. 8.—*Treatment same as No.* 7. Grossly infested with mature ticks. 5th March: Markedly affected. 6th March: Effect very marked. 7th March: No young ticks observed after careful search. Mature semi-engorged female on back right thigh, marked. 8th March: Only two found alive. The mature females appear only just dead.

WHITE COW, RED NECK, BRANDED NO. 9.—*Treatment same as No.* 7. Heavily infested with nymphs and larvae. Some mature ticks on back of udder. 5th March: All affected. 6th March: All badly affected except one on left leg, marked, and one under belly near right flank. 7th March: Marked ticks dead. Marked one on left flank, one on right flank, one on front udder, and two on brisket near point shoulder. 8th March: Marked ticks gone or dead, nothing alive.

YELLOW COW "SCARLET," BRANDED NO. 10.—*Dipped 4th March, 7.0 lb. arsenious oxide per 400 gallons.* Moderately infested, chiefly nymphs and larvae. 5th March: All strongly affected. 6th March: All strongly affected, except perhaps one marked on escutcheon. 7th March: Marked tick gone, all dead, no sign of fresh ticks. 8th March: No ticks left alive.

YELLOW COW "MILKMAID," BRANDED NO. 11.—*Treatment same as No.* 10. Heavily infested on escutcheon, flanks, and udder. Head not submerged. 5th March: All markedly affected. 6th March: One adult marked on point of hip, rest strongly affected. 7th March: Marked tick sick. One marked on right thigh. 8th March; Marked tick on thigh lively. One other found alive.

RED COW, BRANDED NO. 12.—*Treatment same as No.* 10. Lightly infested on escutcheon. Some engorged on udder. 5th March: Mostly affected. 6th March: All nymphs apparently affected. One adult marked high on right leg. 7th March: Only sign of life one male attached to apparently dead female, marked. 8th March: Marked tick gone. Absolutely clean.

The weather during the experiment was mild to warm, and for the most part cloudy and dull. The shade temperature during dipping was 80 degrees Fah. The cattle were in no way injuriously affected.

The ticks began to show the effects of the various fluids in twenty-four hours, and after four days practically no difference could be detected between the results of the different treatments—the lower and higher concentrations having been equally efficacious. This strikingly confirms the results obtained by spraying in the winter of 1917. The action of the medicament was, however, much more rapid on this occasion.

As usual a large number of wandering adult males survived the treatment. In five cases one or two adult females recently emerged from the moult were found in a healthy condition on the third and fourth days after dipping; in all other cases no ticks whatever survived.

Lethal Effect of Arsenate Alone.

On the same occasion as the experiment just described, twelve tick-infested animals were sprayed as detailed below with solutions of sodium arsenate to which the usual amount of emulsion had been added.

Cattle Branded.	Arsenate equivalent to—
13, 14, and 15	·150 per cent. As_2O_3 = 6·0 lb. per 400 gallons.
16, 17, and 18	·200 „ As_2O_3 = 8·0 lb. „ „
19, 20, and 21	250 „ As_2O_3 = 10·0 lb. „ „
22, 23, and 24	·300 „ As_2O_3 = 12·0 lb. „ „

The arsenate was prepared by treating a weighed quantity of pure arsenious oxide with nitric acid, removing excess of the latter by evaporation, and neutralising with sodium hydroxide and carbonate. The whole was then made up to definite volume, and aliquot portions added to 4 gallons of water with which emulsion had been mixed in the proportion of 1 to 400.

One of the animals, No. 24, a wild young heifer, managed to escape from the crush into the dip after spraying, so that no further observations could be made of her.

The results are detailed below.

Red Cow, very poor, branded No. 13.—*Sprayed 4th March, with arsenate = 6 lb. As_2O_3 per 400 gallons.*—Heavily infested in all stages on escutcheon, udder, and under flanks. 5th March: Immature ticks markedly affected. 6th March: Two engorged under tail, puffy. All nymphs affected on escutcheon, adults disappeared except one marked, all engorged females on udder affected. 7th March: On escutcheon a number of mature females apparently just emerged from moult, absolutely unaffected. 8th March: Hundreds of females present about four days old (adult stage). As a final result, spray practically without effect.

White Cow, brown head, branded No. 14.—*Treatment same as No.* 13.—Heavily infested around vulva, on escutcheon, and on udder. 5th March: Affected. 6th March: All apparently affected except one mature female on back of udder, marked. 7th March: Marked tick gone, fourteen apparently unaffected marked; more than this number of healthy ones unmarked. 8th March: Some marked ticks gone, dozens of healthy ones left, also engorged.

Roan Cow, branded No. 15.—*Treatment same as No.* 13. Fairly heavily infested, many engorged on back of udder ready to fall, and a few under flanks. 5th March: Mature ticks affected, immature strongly affected. 6th March: All apparently affected, one mature marked inside right leg. 7th March: Marked tick affected, numerous young nymphs appearing. 8th March: Newly-emerged nymphs all dead. Fourteen semi-engorged and engorged, and dozens of adults about four days emerged apparently quite healthy.

Brown Cow, branded No. 16.—*Sprayed 4th March, with arsenate = 8 lb. As_2O_3 per 400 gallons.* Fairly heavily infested in all stages on escutcheon, slightly under flanks. 5th March: Fair number affected. 6th March: Mostly affected. Two mature semi-engorged marked on back of udder. 7th March: Marked ticks still apparently healthy, four more marked seemingly unaffected. 8th March: More than a dozen healthy mature females present.

Yellow Cow, Curly Horn, branded No. 17.—*Treatment same as No.* 16. Fairly heavily infested on escutcheon and udder, a few ticks under flanks and forearms. Fairly clean forward. 5th March: Affected. 6th March: Nymphs and very small adults seemingly affected. Four unaffected females marked on escutcheon. 7th March: Marked ticks gone. A few newly-emerged becoming visible, also some about three days emerged around thighs. 8th March: More than a dozen healthy mature females present.

DARK ROAN COW, BRANDED No. 18.—*Treatment same as No.* 16. Moderately infested in folds of escutcheon and udder. A few mature unengorged behind shoulder and under forearms. 5th March: Effect marked. 6th March: All apparently badly affected. 7th March: Only one newly-emerged white nymph visible, in centre of escutcheon, marked. 8th March: Marked tick dead. Two nearly engorged and one semi-engorged left quite healthy, two apparently affected.

BROWN COW, WHITE SPOTS, BRANDED No. 19.—*Sprayed 4th March, with arsenate = 10 lb. As_2O_5 per 400 gallons.* Many fully engorged on udder; heavily infested with nymphs, and larvæ on escutcheon. Two mature ticks marked on left flank. 5th March: Very little effect. Marked ticks unaffected. 6th March: Marked ticks gone. One unaffected mature unengorged, marked at base tail; all others affected 7th March: Marked tick gone. Some half dozen apparently just emerged from first moult on escutcheon. 8th March: No healthy females present. Those noted yesterday had grown considerably, but are dying or dead. One removed from flank for close observation not dead yet.

RED ROAN COW, BRANDED No. 20.—*Treatment same as No.* 19. Lightly infested on escutcheon, one engorged marked. Heavy round front of udder. 5th March: Engorged gone. Affected on udder, &c. 6th March: All badly affected, except perhaps one semi-engorged front of udder. 7th March: Numbers of newly-emerged nymphs on escutcheon. 8th March: Newly-emerged dead. Very clean. One mature female left, perhaps affected.

YELLOW SPOTTED COW, BRANDED No. 21.—*Treatment same as No.* 19. Many mature engorged ticks between udder and legs. A few small on brisket. Heavy on escutcheon and under flanks. 5th March: Young ticks markedly affected. Adults not noticeably. 6th March: All markedly affected. 7th March: General effect not so marked as in No. 11. Two each marked on escutcheon, left flank, and left thigh. 8th March: No observation: cow calved during night.

BROWN AND WHITE COW, BRANDED No. 22.—*Sprayed 4th March, with arsenate = 12 lb. As_2O_5 per 400 gallons.* Clean fore; very heavily infested on escutcheon, &c. 5th March: Noticeably affected in all stages. 6th March: All affected, except one on escutcheon, and one on right flank, marked. 7th March: Numbers of nymphs just emerged. 8th March: Nymphs dead. One adult apparently healthy; several noticeably affected.

YOUNG BULL, BRANDED No. 23.—*Treatment same as No* 22. Lightly infested on scrotum and sheath. Otherwise very clean. 5th March · Affected in all stages. 6th March: Three mature between hind legs marked doubtful. 7th March: Marked ticks dead, no sign of newly-emerged ticks. 8th March: No ticks remaining

An examination of the notes recorded in the tables shows that in two days practically all visible ticks appeared to be seriously affected by the arsenate, even at the lowest concentration employed. On the third day, however, with the exception of the young bull, No. 23, which was originally quite the least infested of all, numbers of nymphs appeared newly-emerged from the first moult. Though apparently healthy, a thorough examination of a large number on the following day failed to detect any sign of life.

The outstanding feature of the experiment is the marked decrease in the number of healthy mature females that remained on the fourth day after treatment, corresponding to the gradual increase in the concentration of arsenate. The effect of 12 lb. and 10 lb. is seen to be about equal to that of 3·4 lb. arsenite, while the animals treated with 8 lb. arsenate, and to a greater extent those with 6 lb. had almost the appearance of untreated cattle on the fourth day after spraying. As a final result, therefore, the efficacy of arsenate appears to be rather less than half that of arsenite, probably about one-third.

(*To be continued.*)

Some Suggestions on Spray Management.

[Continued from page 134.]

W. J. ALLEN & W. LE GAY BRERETON.

Transferring the Load.

THE tank of the supply cart should not be of smaller capacity than that of the spray outfit, and, as many sprays will attack metals, the tank should be of wood, and provision should be made for quick transfer of the load from the supply cart to the spray outfit. Some motor spray outfits are fitted with a large suction hose, and the pump can be quickly switched to pump into instead of out of the outfit tank; in some cases the tank of the supply cart can be fitted and so arranged as to discharge quickly through a large tap and hose direct into the spray outfit tank. At Glen Innes Experiment Farm orchard neither of these methods were available, and a more laborious though quite speedy way had to be adopted. A large funnel was made from an empty carbide drum by cutting a hole in the bottom and soldering in a short piece of 2½-inch down piping (see *h*, Fig. 2, and Fig. 5). The drum was wide enough to allow the strainer, made of wood and perforated zinc (see *i*, Fig. 2), to fit right into the top. The ample width at the top and the wide straining surface allowed a bucket of material to be emptied into the funnel rapidly, and the time that would have been necessary carefully to pour the mixture into the small aperture of the tank was thus saved.

Though a well laid out plan for mixing and distributing the spray is a big factor in economy, it will not be fully effective unless it is run on a methodical scheme. Each man in the team, besides being skilful at his job, should know exactly what to do and when to do it without any hesitation. Figs. 4, 5, and 6 will serve to explain the routine followed in the orchard at Glen Innes Experiment Farm

Fig. 4 shows the supply cart just arriving with a load; the mixing station was close enough and arrangements such that the carter could mix and return with a load before the previous load was quite finished. The carter had the buckets and large funnel ready, and followed up the spray outfit to be right on the spot as soon as the previous load was through. As soon as the pressure failed through the spray mixture being finished, nozzle-man No. 1 called the word, and both No. 1 and No. 2 at once cut off and pulled their hose to one side out of the way of the filling operations. No. 1 stopped the engine, and proceeded to oil and examine the engine and pump. Simultaneously No. 2 put the funnel in place, climbed into the cart and loosened the lid of the tank, while the carter backed into position, as shown in Fig. 5. The driver joined No. 2 in the cart, and the two of them bucketed rapidly in rotation, as shown in Fig. 6.

The tank used for carting out was the one already described and shown in Figs. 1 and 2. The lid could be quickly removed, and the top was wide, allowing of rapid filling of the buckets, which were as rapidly emptied into the funnel already described. Directly the last bucket had been poured in No. 2 jumped down, removed the funnel, and regained his hose. The carter simultaneously pulled clear, No. 1 started the engine and regained his hose, and spraying started again.

The points it is specially wished to emphasise are that each man should know his own job during the operation, and that there should be no unnecessary loss of time in deciding where the hoses are to be put out of the way, who is to place the funnel, who is to back in the horse, and so on. Each man should go straight to his job.

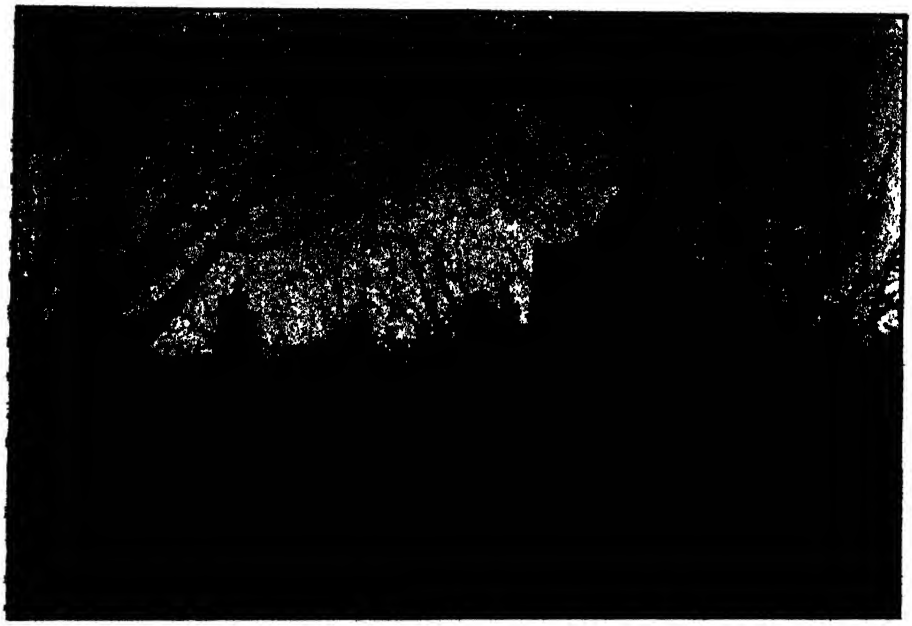

Fig. 4.—The supply cart just arriving with a fresh load of spray mixture.

The supply cart tank at Glen Innes was wide enough to allow two to bail, and the funnel obviated any necessity for the handing of the buckets from one to another, and also enabled the mixture to be poured in rapidly.

At first sight it may appear that with this system a lot of hands are engaged in transferring the load, but it must be remembered that they would otherwise be idle at this time, and also that, if the carter was not employed in mixing and carting out, both nozzle-men would have to travel each time to the mixing station, mix and fill up, and then return to the scene of action.

The greatest opportunity for keeping the outfit pumping spray on to the trees for the maximum possible time while it is out lies in reducing the time when refilling, but the nozzle-men can also do much by methodical and smart work while actually spraying. A nozzle-man should start on the

side of the tree furthest from the outfit and on trees that are trained on a distinct leader system, making a mental note (this will presently become an unconscious habit) of the limb he starts on, and working round the tree until he arrives again at his starting-point.

In working round in the right direction his hose is free for the next tree. The cut-off at the completion of the tree, the move to the next tree, and the recommencement of spraying should all be done smartly. A horse used to the work is a great aid to expeditious spraying, and it is marvellous how soon most horses will get into the work. The horse should move up the centre between the trees and stop or start promptly at the word, thus causing no check in the nozzle-men's work.

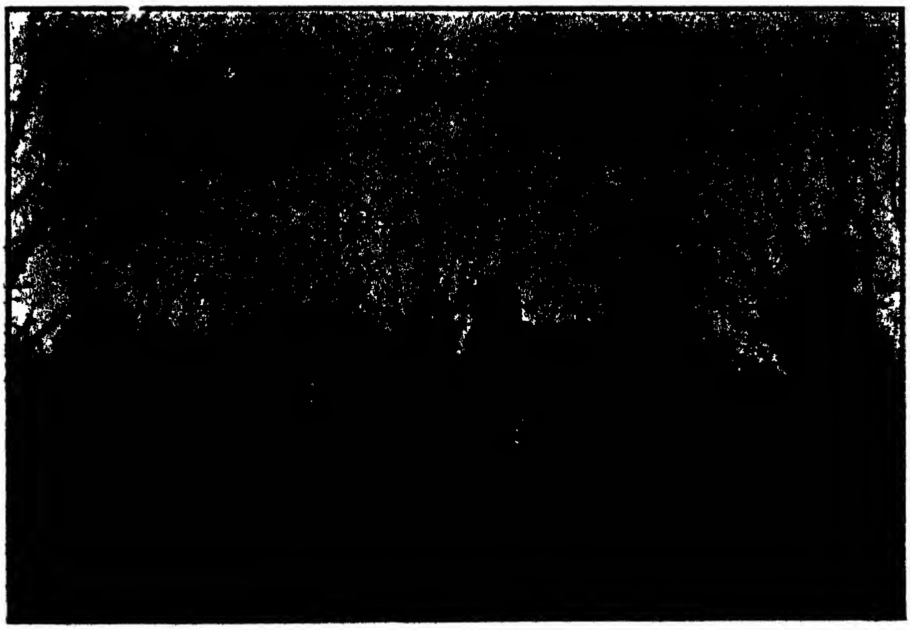

Fig. 5.—Making preparations to transfer the load from the supply cart to the tank of the spray outfit.

A sufficient length of hose is also an important factor in quick work. On trees of wide spread, planted 24 feet apart and using a fair length of rod, 40 feet of hose for each lead is necessary. A long rod requires a greater length of hose than a short one.

It might be mentioned here that a short rod can be handled more quickly than a long one, and it is a mistake to use rods any longer than is necessary.

An ample length of hose to some extent allows independent working between the two nozzle-men. In most rows of tree, smaller or less dense trees are found which are more quickly sprayed than the average. If sufficient length of hose is used the nozzle-man who completes an "easy" tree before the nozzle-man on the opposite row is through, can, by standing the horse up a few feet, start on the next tree without inconvenience to the second

nozzle-man, and work can proceed in this way till the nozzle-man on the more difficult row strikes an easy tree, and the two operators get abreast again. Of course it sometimes happens that two or more easy trees will occur in succession on one row, which will necessitate the nozzle-man on that side waiting. In such cases, if the two nozzle-men are used to working together, one can cross over and help out on the row that is behind. In windy weather it is sometimes an advantage for one nozzle-man to work a tree ahead of the opposite row instead of abreast. Long hoses also allow the horse to be kept out of the spray, and the horse should receive every consideration in this matter. Provided he is not too much in the drift of the spray, his body and neck can be protected by a light hessian cloth.

Fig. 6.—Transferring the load of spray mixture.

The wide opening of the tank of the supply cart, and the wide funnel on the tank of the spray outfit, enable two persons to bucket the spray in rapidly.

When a motor spray outfit was first installed at Glen Innes Experiment Farm the arrangements for the water supply at the mixing station were not of the best, and, although by makeshifts it was possible for the carter to keep up the supply to the outfit without causing loss of time, it was more laborious than would have been the case with adequate arrangements. Whether the arrangements for transferring the load (Figs. 4, 5, and 6) are any less speedy than some less laborious method the writer cannot say, but the average output when working with double nozzles was fifteen 80-gallon loads, equal to 1,200 gallons per day of eight to nine hours.

When spraying for aphis with single nozzles the output was, of course, less, averaging 800 gallons per day of eight to nine hours.

Conveniences for Mixing Sprays.

This subject has been already touched upon under the question of water supply at mixing stations, but it may be useful to deal with the conveniences employed in the mixing of some of the more common sprays.

Lime-sulphur and similar substances that can be prepared beforehand in a concentrated form, offer very little difficulty, as all that is necessary is to have a convenient means of drawing off the measured quantities and a quick means (already mentioned) of adding, single-handed, the necessary water for diluting. The making of the concentrated lime-sulphur on community lines was the subject of some suggestions in "Orchard Notes" in this *Gazette*, October, 1922.

Lead arsenate takes a little time to reduce to a cream form ready to mix with the water. Time can be saved during the day, and the supply kept up to the spray outfit more expeditiously, if sufficient paste or powder for a day's spraying is reduced to a cream condition with a measured amount of water the night before.

Provided the number of pounds used to the measured amount of water to produce the cream is known, the dose can then be measured out for each load of spray. Care must be taken that the cream is *very thoroughly stirred*, and that there is no sediment at the bottom before each dose is measured out, also that the water used to reduce to cream is free from any mineral or other matter that might upset the arsenate, as water that might be quite safe if used to dilute spray for immediate use might cause considerable change in the arsenate if allowed to soak all day.

Tobacco wash.—Directions for producing this useful aphis spray in large quantities are obtainable in Spray Leaflet No. 2, from the Department of Agriculture, free of charge, but reference to Fig. 7, in conjunction with the following notes, may serve to make the directions in the leaflet more clear.

After 250 lb. of tobacco, sufficient for nine 80-gallon loads, has been soaked for the required time in either hot or cold water in a 200-gallon cauldron, or other receptacle, it is thrown out on to the corrugated iron platform. The tobacco will absorb some of the water while in soak, and for convenience in measuring out a ninth of the decoction for each load of spray, water is added to bring it up to a known mark on the receptacle. When adding this water it is poured over the soaked tobacco stalks to wash back any decoction that is adhering to them.

If the stalks are received in a chaffed condition it is better to put them into old bags for soaking.

It might be stated that with three 200-gallon boilers it has been found possible, with care, to keep up a continuous supply of 800 to 900 gallons of wash per day. As this wash is used through single nozzles the carter on the supply cart is not so hurried as when keeping up the supply to double nozzles on each lead of hose. He has more time to look after the preparation, and when a cauldron is partly used he should utilise any spare time in bailing out the remains of the decoction into a cask, in order to allow of the cauldron being started again with a fresh lot. If a cauldron is empty at "knock off" time the man in charge should get it started again that

night, so as to be sure of keeping up a sufficient supply for continuous spraying. The arrangement for weighing in the tobacco stalks should be convenient, so that it can be worked single-handed, and without loss of time.

Resin soda wash can be put up beforehand in fairly concentrated form, the jelly it cools into being broken down and diluted correctly with hot water, a procedure that saves a lot of time when spraying. Under some conditions the whole of the water for mixing requires to be hot for this spray. Square iron tanks may be used to keep up this supply of hot water, but cast-iron cauldrons are preferable because they last so much longer. Mr. A. A. Ramsay, Principal Assistant Chemist of the Department, has recently carried out some investigations in the manufacture of this spray, results of which will appear in this *Gazette* shortly.

Fig. 7.—Rinsing down tobacco stalks for spray after they have been soaked.

Miscible oils do not require any elaborate arrangements beyond a supply of water by which the tank of the supply cart can be quickly filled, but where any quantity is being put out it is worth while having a small pump fitted on to a trestle by which the oil, when it is first mixed with about an equal quantity of water, can be pumped through into another receptacle before dilution with the bulk of the water (see Fig. 8). Instead of a short piece of hose the delivery into the other bucket should be through a bent iron pipe, as the oil in this concentrated condition will destroy the hose very quickly. The outlet of the delivering pipe should not be too large, so that a fair pressure can be maintained. An old Bordeaux type of nozzle, set wide open on the end of the pipe, serves well for this purpose. When the water and oil are passed through the small pump in this way, they are thoroughly churned together under pressure by the plunger of the pump, before the bulk of the water is added; the mixture will come out in a cream which mixes easily with the bulk of the water, and does not readily separate.

Bordeaux mixture, owing to its liability to russet the fruit, has not been used so widely by the apple and pear growers of this State as in Victoria and Tasmania, but grape growers, especially since downy mildew has made its appearance, use large quantities both for that disease and for black spot. It is in the preparation of Bordeaux mixture especially, perhaps, that there takes place that loss of time, the reduction of which is so essential, and in the case of Bordeaux it is particularly essential, because spraying for the

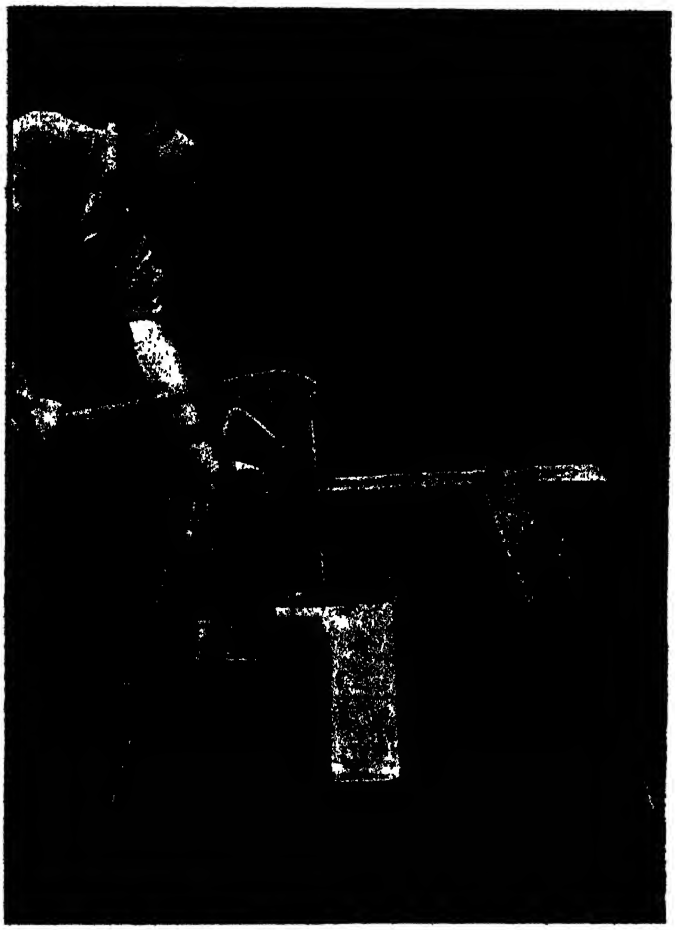

Fig. 8.—Thorough mixing of oil sprays is essential.

A small pump fitted on a trestle and delivering into another receptacle through a bent iron pipe makes a capital mixing plant.

diseases for which this mixture is mostly used in this State must be carried out during certain limited periods if it is to be effective. How often is it the case when a load is completed that the nozzle-men have to come up to the mixing station, weigh out and dissolve the bluestone (even perhaps lighting a fire to obtain hot water for this purpose), slake the lime, and then make the mixture before spraying is started again? Often, too, the water required for mixing has to be obtained by very inconvenient and

slow means. The question of water supply and rapid filling has already been dealt with. Let us see how time can be saved during spraying operations in reference to the other items.

Sufficient bluestone for a day's work or longer should be dissolved in a known quantity of water—1 lb. to 1 gallon is a handy amount to work, but it can be made more concentrated provided the amounts are known, and it is under the point of saturation. This can be done by the well-known method of placing the weighed out bluestone in a piece of porous sacking, suspending it just under the surface of the measured quantity of water in a cask twelve hours or so beforehand. The right quantity of bluestone is then obtained quickly by measuring out so much of the concentrated stock solution, placing it in the bluestone solution cask, and adding water up to the mark for the required quantity.

A weighed quantity of lime can be slacked beforehand in a large receptacle (a 200-gallon tank with the top cut out is suitable), measuring the quantity of water used, which should be sufficient to reduce the lime to a cream. The lime can then be measured out, and reduced with water at time of mixing in a manner similar to that described for the bluestone, care being taken that the stock mixture of lime cream is thoroughly stirred, not neglecting the corners round the edges of the receptacle, before measuring out the desired quantities. When stock solutions or mixtures are to be held for such a period that evaporation appreciably decreases the quantity of water, a mark should be made at the level of the last dipping so that the right quantity of water can be added before using again. The results of investigations in the storage of lime for sprays under water were reported in an article by Mr Ramsay in the *Gazette* in January.

(*To be continued.*)

Some Useful Pamphlets.

The Department has lately made some useful additions to its list of free pamphlets. One of these is "Sheep Maggot Flies," a well illustrated twelve-page publication comprising No 3 of the insect pests series. Another is "Maize: Its Protection from Insects in Store and Field," a copiously illustrated pamphlet of substantial size. "Pickling Seed Wheat" is a leaflet of distinct importance just now, and "To the Last Tick" is another little publication that deserves wide publicity, on the North Coast. Two fruit-growing publications of seasonable significance are "Packing and Marketing Fruit" and "Laying Out and Planting an Orchard," while "Trees for Shade and Shelter" should be in the hands of every owner of stock. All are available gratis to farmers on application to the Under Secretary and Director, Department of Agriculture, Sydney.

It is well known that the more animals are improved and specialised in their line, the more particular they are as regards the surrounding conditions in which they live.—*Agricultural Gazette of Canada.*

Insect Pests of the Cultivated Cotton Plant.

No. 3.—Cotton Stainers and other Plant Bugs.

WALTER W. FROGGATT, F.L.S., Government Entomologist.

In the Order *Hemiptera* there are a number of different species of plant bugs of economic importance. They belong to cosmopolitan genera that have representatives scattered all over the globe. Among those that are recorded as pests upon the cotton plant are a number of species of the genera *Dysdercus* and *Oxycarenus*. They damage the cotton crop in two ways. First, they cluster over the cotton bolls and suck up the substance of the unripe seeds, and thus destroy their germinating power. Secondly, they foul or stain with their excrement the beautiful white lint bursting out of the opening bolls. A number of species of the genus *Dysdercus* are, on this account, popularly known as "cotton stainers," and as most of them have a more or less uniform reddish or reddish-brown tint they also bear the popular name of "red bug." The typical *Dysdercus* is a moderate-sized bug, about half an inch in length, with a uniform, elongate, boat-shaped body. The head is small, bluntly angulated in front, with small, prominent, rounded black eyes, and long, slender, four-jointed antennæ standing out on either side in front, just below the eyes. The prothorax, narrow in front, fits close against the hind margin of the head, and forms a raised ridge or fold in front; the side margins form a thin flange; the hind margin is straight and slightly puffed up on the sides. The pronotum forms a small, well-defined triangle behind. The long forewings are folded flat down over the back. The rostrum or beak is folded under the head and body, and is very long, often extending up to the second segment of the abdomen. The legs are long and slender, and well adapted for the very active life the insects lead in all stages of development.

The members of the Genus *Oxycarenus* are much smaller plant bugs. They measure about one-sixth of an inch in length. The adults are variegated with black, grey, and white. The head is short, broad, angulated on the sides to the blunt apex; eyes prominent, black, rounded on the sides and truncate on the hind margin. The antennæ, consisting of four joints, the terminal one elongate, thickened, and rounded at the tip. The rostrum folded between the legs along the under surface of the thorax segments. The body, including the thorax and folded forewings, elongate, oval. Legs rather short.

In Egypt the commonest cotton-stainer is *Oxycarenus hyalinipennis* Costa, though there are several other species with similar habits, three being recorded from Uganda.

There are three species of red cotton-stainers in the West Indies and in the southern States of the United States of America. *Dysdercus suturellus* is commonest in the Bahamas and the United States, and *Dysdercus andreæ* and *D. delauneyi* are pests of the West Indian cotton fields. In India the red cotton bug, *Dysdercus cingulatus*, feeds upon the sap of the leaves and stem, and particularly the soft seeds in the cotton of the ripening bolls. Such infested seeds are valueless. They also congregate in the open bolls and stain the exposed cotton with their excrement. The Dusky cotton bug, *Oxycarenus laetus*, is also common in many parts of India. The females lay their eggs in the open bolls, and the young larva, which is furnished with a very long proboscis, is able to destroy the seeds.

Both these two groups of plant bugs are well represented in the *Hemiptera* fauna of Australia. In times past, both these and other allied forms have been found damaging cotton plants in the experimental plots of this plant at our various agricultural stations.

The Rutherglen Bug (*Nysius vinitor*, Bergroth).

This plant bug is very common in the opening cotton bolls, and also upon the foliage of cotton plants at our experiment farms and in gardens. Where cotton is planted as a regular field crop, this bug will certainly have to be considered among its pests. Though one of the smallest bugs, it is one of the most numerous, and, like the Coon bug, it appears in orchard and field crops in countless millions. It sucks up the sap of the foliage and causes it to wilt; it congregates on the ripening fruit and spoils it both by puncturing it with its rostrum and by soiling it with its excrement. When it attacks ripening seeds, such as onion and carrot seed, it sucks all the moisture out of them, and they wither up on the stalk. It has on several occasions done considerable damage to ripening wheat, and in a time of drought in the north-west, when all other green plants had dried up, the Rutherglen bug lived upon the prickly pear.

Besides being cosmopolitan as to its food-plants, it has an extended range over the greater part of Australia, from east to west. It is a pest in the gardens of Sydney and in the orchards and field crops beyond. In the western interior it may be found in the early summer swarming over the herbage on the banks of the Darling and Murrumbidgee Rivers, or on the fruit in the home-station gardens.

It takes its popular name from the fact that it was first noticed as a pest infesting the grape vines in the Rutherglen district, and later on French described it from Victoria as a cherry orchard pest, giving it the somewhat misleading popular name of the Rutherglen fly pest, which name, though the insect is a true plant bug, and is not related to the *Diptera*, has been adopted by popular writers.

This little bug is so well known that it requires no detailed description. Briefly, it is of a uniform brown colour with silvery-tinted wings, somewhat slender in form and about one-sixth of an inch in length. It is a very active

little creature, both on the ground and upon the foliage, runs rapidly when disturbed, and flies well. The eggs are deposited upon the grass and herbage, where the baby bugs hatch out and shelter while they are developing; so that clean cultivation round a paddock is a great preventive measure.

The Coon Bug (*Oxycarenus luctuosus*, Montrz.).

This little bug was originally described by Montrozier from New Caledonia in 1864, but it is certainly indigenous to Australia, as it has a very wide range far inland, where it sometimes breeds in immense swarms, chiefly destructive to grass and herbage.

The eggs are deposited on the grass. The freshly hatched larvæ, until the wings are developed, are bright red, and I have seen a mile of fence posts along a roadside so covered with these resting larval bugs that the posts looked as if they had been coated with red paint. The adult bugs frequently mass together in the same way as the baby grasshoppers, and one may sometimes find several acres thickly covered with a moving mass of these plant bugs. They are nearly always found upon odd cotton plants growing in gardens. This insect is well known in the bolls of cotton plots grown at our experiment farms, and will certainly be one of the cotton bugs that will come into our commercial cotton fields.

The adult bug is smaller than the Rutherglen bug. It is of a uniform black colour; reddish eyes and ocelli; elytra white, folded over the hind wings, with a rounded black blotch on each side in the middle of the back, and a dull fuscous blotch in the centre towards the tip of the abdomen.

The Red Cotton Bug (*Dysdercus sidæ*, Montrz.).

This bug was originally described in 1861 from Australia. It has a wide range over New South Wales and Queensland. In the western scrub-lands it breeds upon the trunks of the wilga (*Geijera parvifolia*). The tiny, round-bodied, immature larvæ are bright red, and often cluster together among the red seeds which they mimic in colour. At other times they shelter in cracks in the bark. Later on, the perfect bugs collect under the fallen logs in large numbers. They also often migrate in large numbers into houses built among wilga trees; they mass together under the shelter of the verandah or the overhanging eaves.

This is a typical cotton stainer, closely allied to the American members of the genus. It is found upon many other different plants. The adult bug measures half an inch in length. General colour on dorsal surface dull reddish brown; head red, with the front antennæ, hind margin, and eyes black; the prothorax margined with yellow in front followed by a black band; scutellum black, a rounded black spot on either side in the centre of the reddish wing covers, the apical portion of the tegmana brownish-black. Under surface of thorax and abdominal segments barred with white. This bug has been frequently found on cotton bolls.

The Parti-coloured Cotton Bug (*Oncopeltus quadriguttatus*, Fabr.).

This species has a wide range over New South Wales, from the Tweed River to Sydney; specimens were first noticed by the writer in 1897, in all stages of development, from the eggs to the adult bugs, upon the cotton plots at the Wollongbar Experiment Farm.

They are very prolific, as the round glassy eggs are attached to the slender twigs encircling them with a broad band containing up to one hundred eggs. The freshly emerged larval bugs are bright red, with dark-coloured legs and antennæ, and mottled on the upper and lower surface with metallic purple. The general form is almost circular, convex on the upper and flattened on the under side. The adult bug measures half an inch in length, the head is red with the dark-coloured thorax marked with two red spots in the centre, the orange-coloured scutellum marked with black, and the basal half of the forewings orange yellow and the lower half black. The antennæ and legs black, with the under surface of the thorax mottled with deep purple and the abdomen reddish-brown. The whole of the under surface and legs clothed with fine hairs.

The Bureau Conference at Parkes.

The third annual conference of branches of the Agricultural Bureau situated in the western district will be held at the Masonic Hall, Parkes, on 11th, 12th, and 13th of April. This conference has become an event of more than local significance, and the schedule of the 1923 proceedings covers matters of interest to every farmer in the State. An important feature will be the discussion of the proposed rural credit legislation, the occasion providing farmers with a unique opportunity of debating, before they actually become law, proposals that affect them closely. It is argued that all who have an interest in agriculture (irrespective of membership of the Bureau) and who are resident within reach of Parkes, should avail themselves of this chance of making themselves familiar with the clauses of the proposed Bill.

Another matter closely affecting all engaged in rural pursuits will be the conference discussion on the subject of woman's part in the promotion of the community spirit. It is hoped that as many branches of the Bureau as possible will send lady representatives, and that visiting farmers will be accompanied by their womenfolk.

The opening address will be given by the Minister for Agriculture, the Hon. F. A. Chaffey, and among those present will be many others eminent in relation to agriculture. Branches should not fail to avail themselves of this occasion for the thorough ventilation of members' views on matters agricultural.

Ten years' experiments at Glen Innes Experiment Farm with various fertilisers for oats show large increases from complete manures, but superphosphate alone, a comparatively inexpensive manure, gave results that should easily convince the farmer of its efficacy on similar soils.—From a recent report by Mr. R. H. Gennys.

The Queen Bee Competition at Wauchope.

W. A. GOODACRE, Senior Apiary Instructor.

THE bees entered for the queen bee competition arranged by the Department, in conjunction with the New South Wales Apiarists' Association, were received at the Government Apiary, Wauchope, on 14th and 15th November last. The majority of the cages contained from nine to twelve attendant worker bees with the queen, and in these cases every bee arrived alive. In several instances, however, a larger number of attendant bees were included, and in each of these cages several dead attendants were found. All the queens were in good lively condition, but immediate attention was necessary where dead bees were present, for in two cases the opening leading to the food was blocked up by dead bees. Evidently it is not a good practice to place more than twelve attendant bees in the cages when mailing.

Forming the Nuclei Colonies.

The hives (eight-frame full depth) were set on concrete blocks, placed 10 feet apart, the entrances to the hives facing north-east. The bees for the nuclei colonies were obtained from the out apiary, so that no trouble would be experienced with bees returning to their homes. In each hive was placed one frame of sealed honey, one frame of brood, one empty comb, and one full sheet of comb foundation. Special care was taken in the selection of the comb, so that as far as possible no competitor should have any advantage. As it was known when the queen bees were to arrive, a good deal of the selection of the combs and bees had been made beforehand. It was necessary to give consideration to the temperament of the colonies from which the bees were obtained, for the bees from different colonies may vary in a number of ways. Sufficient bees to cover two frames well were put in each hive.

Introducing the Queens.

Towards the late afternoon on the day they were received the queen bees, still with their attendants in the mailing cages, were placed in their respective hives. The labels over the wire cloth screen of the cages were removed so that there might be free communication with the bees in the nuclei colonies.

The cages were placed on the floor of the hive, screen upwards, and then pushed under the bottom bars of the frames near the back of the hive. The liberating cork in the cage was not withdrawn. The hives were not interfered with until the following afternoon, when the cages were removed one at a time and taken indoors near a window, and the queens (only) transferred to Miller cages. After the introduction of the Miller cage the colonies were not interfered with for seven days, when all the queens were found to be accepted and laying well.

The Progress Made.

On 1st December (the date of the actual commencement of the competition) each colony had its two centre combs nicely established with brood. The frame against the wall of the hive contained comb-foundation only, and the outside comb solid sealed honey. Owing to the poor condition obtaining in the fields the bees had been unable to build out the comb foundation, and on the date mentioned new frames of foundation were substituted for those in the hives, and 3 lb. of thinned-down honey given to each colony; the feeding covering a period of four days With this stimulant, combined with a dribble of honey coming in from the fields, the bees built out the foundation.

On 23rd December young bees were emerging freely from the brood, and the colonies had fully occupied the four frames. An extra frame of comb-foundation (full sheet) was placed between the third comb and the frame of honey. On this occasion 2½ lb. of thinned-down honey were fed to the bees to get them to build out the foundation. On the 30th December the colonies had the five frames well in use, with their brood nest spread on to four frames.

This progress must be considered good, in view of the adverse conditions obtaining. There is a good variation in the strains of the bees competing, and it is interesting to note the different characteristics and the different procedure of the colonies in their building up operations.

THE VITAMINE VALUE OF SOME COMMON FRUITS.

FRUITS vary considerably in their vitamine content. In the following table ("The Vitamine," Sherman and Smith, 1922, page 209, &c.) is shown the significance of some common fruits in relation to the vitamines A, B, and C:—

	Vitamine A	Vitamine B	Vitamine C
Apples	+	+	+
Bananas	+?	+?	+
Lemons	*	+ +	+ + +
Mulberries	*	*	+
Oranges	+	+ +	+ + +
Pears	*	+	*
Prunes	*	+	–
Raspberries	*	*	+ + +
Tomatoes	+ ?	+ + +	+ + +

+ indicates that the fruit contains the vitamine.
+ + indicates that the fruit is a good source of the vitamine.
+ + + indicates that the fruit is an excellent source of the vitamine.
– indicates that the fruit contains no appreciable amount of the vitamine.
? indicates doubt as to presence or relative amount.
* indicates that evidence is lacking or appears insufficient.

—A. A. RAMSAY.

Pure Seed.

Growers Recommended by the Department

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Wheat:—

Bomen	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	E. J. Allen, Gregra.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Canberra...	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Hughes Bros., Greenacres, Pullabooka, *via* Grenfell.
	H. M. Hall and Sons, Studbrook, Cunningar.
	W. W. Watson, Woodbine, Tichborne.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	T. M. Slattery, Mirrool.
	E. J. Allen, Gregra.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
	R. J. O. Berryman, Aviemore, Botfields.
Canberra (ungraded)	Meurant Bros., Cundumbul, Molong.
Clarendon	Manager, Experiment Farm, Glen Innes.
Cleveland	W. Burns, Goongirwarrie Carcoar.
	A. J. Rial, Wolseley Park.
College Purple ...	Manager, Experiment Farm, Temora.
	Hughston Bros., Hughstonia.
Currawa	E. J. Allen, Gregra.
	Hughston Bros., Hughstonia.
Federation	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	R. McCrone and Son., Bungambil, Mirrool.
	T. M. Slattery, Mirrool.
	Hannett Bros. and Wilson, Wellville, Cunningar
Firbank	T. M. Slattery, Mirrool.
Florence	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Glen Innes.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Temora.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	E. J. Allen, Gregra.
Hamel	Manager, Experiment Farm, Temora.
Hard Federation	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	N. Campbell, Glasleck, Curlewis.
Improved Steinwedel	Manager, Experiment Farm, Temora.
	W. W. Watson, Woodbine, Tichborne.
Major	Manager, Experiment Farm, Temora.
	Hughston Bros., Hughstonia

Wheat—continued.

Marshall's No. 3	Manager, Wagga Experiment Farm, Bomen.
	Hobson Bros., Glenlea, Cunningar.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	A. J. Rial, Wolseley Park.
Penny	W. W. Watson, Woodbine, Tichborne.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Rymer	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Sunset	Manager, Experiment Farm, Coonamble.
Thew	H. M. Hall and Sons, Studbrook, Cunningar.
Union	Manager, Experiment Farm, Temora.
Wandilla...	Manager, Experiment Farm, Temora.
Warden	Manager, Wagga Experiment Farm, Bomen.
	W. W. Watson, Woodbine, Tichborne.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
	Hughston Bros., Hughstonia.
	B. J. Stocks, Linden Hills, Cunningar.
Yandilla King	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Hobson Bros., Glenlea, Cunningar.
	Hughston Bros., Hughstonia.
	A. J. Rial, Wolseley Park.
	Hannett Bros. and Wilson, Wellville, Cunningar.
Yandilla King (ungraded) ...	W. V. Herbert, Bongalong, Muttama.

Oats:—

Algerian	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Glen Innes.
	W. Burns, Goongirwarrie, Carcoar.
	Gollasch Bros., Pine Park, Milbrulong.
Guyra	Manager, Experiment Farm, Glen Innes.
Mulga	Manager, Experiment Farm, Glen Innes.
Sunrise	W. W. Watson, Woodbine, Tichborne.
	Gollasch Bros., Pine Park, Milbrulong.
White Tartarian	Manager, Experiment Farm, Glen Innes.

Barley:—

Cape	Manager, Experiment Farm, Temora.
Chevalier	A. J. Rial, Wolseley Park.
Kinver	Manager, Experiment Farm, Temora.
Pryor	Manager, Experiment Farm, Temora.
Trabut	A. J. Rial, Wolseley Park.

Lucerne:—

	W. E. Myring and Son, "Nungaroi," Pallamallawa.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

Poultry Notes.

March.

JAMES HADLINGTON, Poultry Expert.

The autumn months usually bring some anxiety to the poultry-farmer in respect of the pullets of the previous season's hatching, for while they are of the age when they might reasonably be expected to lay, their trickiness in this respect is well known. Many of the pullets that have started to lay, and some perhaps that have laid for the last couple of months, will suddenly cease. When this happens in March, April, or May, the chances are that they will go into a moult, and this will generally keep them off laying for six weeks to two or even three months. It is generally June before much improvement in egg production can be expected.

It is not only that so many less eggs are produced, but the months mentioned are those during which the highest prices are ruling for eggs, so that the feature is a most important one. The farmer who is fortunate or skilful enough to be able to keep his pullets laying during this period has scored a tremendous advantage, and no effort or precaution is too great to put forward to secure autumn laying.

Factors in the Case.

Many poultry-farmers by careful work and persistent effort manage to secure a good return from their pullets in most years. Others scarcely ever get any good out of them before June or July in any year. The difference is not entirely due to luck, breed, or strain, but is mostly dependent upon the skill and attention bestowed upon the rearing and subsequent management of the pullets The factors that influence good laying of pullets apart from breed or strain, might be summarised as follows:—

(a) The nature of the rearing methods;
(b) The character and incidence of feeding; and
(c) The skill of the attendant and the attention given each department, in other words the management of the flock.

It might be emphasised that feeding hens two or three times per day, supplying green feed, shell grit, &c., and performing obviously necessary duties on the farm do not necessarily constitute skilled attention to the flock. The beginner is often years before he fully realises the importance of small things and of certain considerations that should enter into the management of his hens. He will usually aver that he is feeding on a balanced ration, that he has done all the things laid down for his guidance both in feeding and rearing, but has still failed to get good returns, therefore the fault must be with his hens. Finally, he consoles himself with the idea that his hens are a bad laying strain. This view often leads to an unnecessary

expenditure of money that can ill be spared on the purchase of reputedly heavy-laying strains, or on some "system" claiming to improve production. Such is the mental attitude of hundreds who fail in poultry farming. In this connection, and while admitting individual good and bad layers, I must say that I have never known a bad laying strain in White Leghorns. The average of that breed when well reared is all that is really necessary to secure a good average result in production—if we can secure a super-result, of course, all the better. This breed can then be taken as representative of egg-laying for our present purpose, especially as it constitutes probably two-thirds of the stock run on commercial egg farms.

The Lesson.

The lesson to be learnt from what has been set out is that it is not sufficient merely to run a flock of hens or pullets as if they were machines, but to remember that each unit of that flock is a delicate organism, and that it is dependent upon being kept up to concert pitch in health and well-being if it is to do its best in egg-laying. The slightest deviation from a perfect state of health will react in such a way as to stop egg-production. If proof of this were necessary we have it in the fact that a couple of days of wind or rain is often responsible for a considerable falling off in the production from a flock, and that a week's sunshine will often greatly improve matters, though as a rule not so quickly as in the case of cessation of laying.

Many poultry-farmers marvel at how it is possible for a hen to be thrown off laying so quickly, but the mystery is solved in the light of the fact that unless the yolk has actually become detached and entered the oviduct it can be re-absorbed. If, then, this often takes place from such a simple and natural thing as a change of the weather, how much more so from other things, such as change of feed or environment. All this goes to show that tranquility and a good state of health are necessary to secure satisfactory results. It will be found that the flock of hens or pullets will give good results whose owner, by sympathetic treatment and close attention to their requirements, has kept his birds in health. The reverse will just as surely bring failure.

It is often said that to succeed with poultry one must have a great liking for them. It can be readily understood that to such a one the work of tending them is much more congenial than if he has no such predisposition, but it might be asked, how many persons are in the fortunate position of finding their occupations entirely congenial? Surely the circumstance that one is not exactly imbued with a love for poultry should not altogether make for failure, though lack of aptitude for the mass of detail necessary to success must be a serious drawback.

Pullets for Competition.

Some observations on selection and treatment of the pullets entered for the forthcoming competition just now may be of service to new competitors. Admittedly, many a novice has scored well in these competitions, but it will be also observed that most of the more experienced competitors invariably secure

good positions in the lists, and perhaps not always on account of the superior breeding of their birds. Be that as it may, there is no gainsaying the fact that whatever the breeding of the birds, the ultimate issue depends mostly on selection and on the treatment of the birds prior to their being sent away. From a knowledge of many of the yards represented, I have no doubt that in many cases better selections and better results could be obtained, and some of the points to be observed may be stated with advantage

Selection.

In the first place it is presumed that the competitor has already learned how to judged a prospective good from a bad layer. If not, I commend to him the chapter on this subject in "Poultry Farming in New South Wales." Next to this comes judgment based upon a knowledge of the behaviour of his stock in regard to how they come on to lay, their liability to break up at any point or age, and the incidence of their laying.

In the first selection, which should be made now, the competitor should not content himself with selecting six pullets. It is better to select about twenty, from which the final selection of six can be made later on. The best plan is to pen these birds in a rather small enclosure, to get them accustomed to the restricted area of the competition pens. They should be kept under observation and a gradual elimination made with as little disturbance of the whole pen as possible. The pullets that are showing most promise are, of course, the ones to keep back for the final selection They should be handled from time to time to ascertain if the skin of the abdomen is remaining pliable and of a silky nature. Any that tend to hardness should be rejected.

The Feeding

Another important matter is that of pullets accustomed to the ration fed to the competition birds. This is most essential. If, for instance, the pullets intended for the test have been fed on dry mash, they should be very gradually brought on to a wet mash containing the same ingredients as the ration that will be fed to them in the test. All other items in the ration should be gradually eliminated. The green feed should consist of lucerne, if possible, as this is what will be fed to them at the College. Moreover, it should be fed to them at midday. These may appear trivial matters, but they all have a bearing on the well-being of the pullets, which is the main consideration.

In this connection, it might be pointed out that any change in food, or in the incidence of feeding, is detrimental to production. It should be taken as an axiom that poultry do best on the food they are most accustomed to, providing always that it is a good ration.

Exhibition of Utility Stock.

The poor condition in which many of the utility birds are shown is a subject of comment at all shows where utility classes are provided, and none more so than at the two big metropolitan shows—the R.A.S. and the Poultry

Club's. This applies to all breeds, more or less, but particularly to White Leghorns, either because they have not been washed, or because they have been badly washed. In many cases bad washing is worse than no washing at all—the result of lack of experience and want of knowledge on the part of the owner.

Another point is that the birds have not been "got ready" for show, with the result that many good birds fail to score sufficiently high to appear in the cards. In view of the near approach of the showing season a few hints on getting birds up for exhibition may be offered. In moving about among utility breeders' yards I have often had birds pointed out to me that were intended for exhibition, with the remark that they had been put up in a small coop or outhouse for a few days to get them quiet preparatory to the show. The practice is a big mistake. If a bird is to be penned up for a few days only, it is much better that he or she should not be penned at all. It is worse than useless to pen for a short period. To get birds up for show properly the penning should extend over about six weeks, some birds take longer. Coops, 36 in. x 30 in., are about a good size for the purpose. During the first two weeks of penning the birds usually go off in condition, so much so that the owner will perhaps wonder why he ever selected such a poor specimen, but let him wait another two weeks, and if the bird is being properly treated he will begin to see an improvement, and by the end of the sixth week it should be in the pink of condition—providing it is a bird that will stand penning, and there are some that will not.

During this time, all that is necessary is careful feeding and training so that it will stand to be examined by the judge. It is best, however, not to attempt to handle the bird for the first week, and until it has got a little used to its confinement in a small space. The novice will be surprised to find the extent to which the bird will improve under these conditions, even with only ordinary feeding and an occasional dose of epsom salts—the latter particularly during the first two weeks.

Following on this, it is usually necessary to wash a white bird. This is an operation at which many fail, but with the aid of a few hints there is no reason why they should. First of all, then, it is assumed that the bird to be shown has been "got up" into condition. To wash it plenty of warm water and towels and three large bath tubs should be provided, and a coop that is lined with clean crash or some such material. This coop should be placed either in the sun or before a stove, so that the bird can be put into it dry. If it is in the sun, care should be taken to protect the white lobes or they will be scalded by the sun striking the lobe, and the result will be blisters that later on will leave red spots in the lobe and cause the skin to become creased and wrinkled.

Washing.

In the actual washing of a bird it is necessary to have three waters, the first being the soap water, to make which about a quarter of a pound of good soap (white Castile is best) should be cut into slices and dissolved in about half a gallon of hot water. Pour this into about five gallons of luke warm water,

and into the lot plunge the bird, over the head to start with, and then holding the head out of water while the soap water is rubbed well into the feathers. And now comes an important point. The bird must be thoroughly soaked and sufficient time given in soaking to loosen the dirt. Usually about ten minutes is required, but the dirtier the bird the greater the length of time necessary in this bath.

Next put the bird through a rinsing water which will remove the soap. There must be plenty of water to do this thoroughly.

Again, the bird should be plunged into another, the third and final bath, to remove the last possible trace of soap. Failure to remove all the soap will cause complete failure in washing. Most washers use the laundry blue bag in this last water, but it must be employed sparingly and the water must not be made darker than a light sky blue.

Finally, stroke all the water possible out of the feathers and dry off with clean towels.

While at work, a pad of sacks covered with a clean towel should be placed over the knees of the operator, who should be seated on a low stool or chair. The bird should then be put into the drying coop, and every care taken to avoid dirt or dust. Washing should be done one or two days before the show to allow of the bird "preening" his feathers to web them out. It is fatal to good results to wash a bird twice inside one week. Therefore it is necessary to make sure of the first operation. Amateurs should practice on a bird not intended to be shown, in order to get used to the work.

All this might seem to involve a good deal of effort, but the experienced exhibitor of poultry knows that there is much to do to get individual birds properly ready for show, and knows, too, that he will be amply repaid for this work.

Flue-curing of Tobacco.

It is observed that, owing to the dryness of the season, some tobacco is ripening prematurely. Growers who are flue-curing their leaf are advised to exercise care in the early stage of curing in the barn. If the leaf cells are killed by drying too rapidly, the tobacco cures out with too much green—a colour not desired by the manufacturers.

Growers who are flue-curing should note the following brief points:—

1. Select plants of the same degree of ripeness, texture, and colour. This is of primary importance.
2. Fill the barn with tobacco which has all been cut on the same day.
3. Hang the tobacco so that it does not touch the next stick, and in such a manner that the leaves do not jamb one against the other.
4. Do not dry out the leaf in the barn before the green colour has been eliminated.
5. If the tobacco shows signs of drying too fast above where the flue enters the barn, lower the temperature.
6. As a rule, the more heat the leaf will stand up to 110 degrees Fah. in yellowing, the better it will cure.

—C. J. Tregenna, Tobacco Expert.

March Work in the Apiary.

W. A. GOODACRE, Senior Apiary Instructor.

It may seem rather early to mention winter conditions, but to gain the most success in bee-farming one must look ahead. Where conditions are favourable for progress in the hives during March, the prospect for successful wintering of the colonies will almost invariably be good, even though trying times have been experienced by the bees earlier in the season. A large force of young bees in good sound hives, with an ample supply of good food, is the best assurance for success in wintering. When the matter of giving encouragement to the colonies to raise them has been left until winter conditions are in evidence, it is often too late to get the best force of young bees ; hence the reason for earlier preparation. There are several methods which can be employed to induce a colony to provide an extra number of young bees, and in this relation the presence of a young queen in the hive plays a very important part. It is quite a usual practice for a young queen of a vigorous strain to keep on laying for weeks after the old ones have ceased their season's progressive work. A test was made regarding the work of queen bees of different ages at the Government Apiary during the past autumn, and, although in bee-farming we have to make allowance for difference in conditions, it was found that the young queens introduced to the hives during March induced the colonies during the following month to raise fully 100 per cent. more brood than a three year-old queen, and about 50 per cent. more than a two year-old queen. Apart from the advantage gained by having an extra force of young bees to go into winter, by having the young queens in the early spring the colonies were better prepared for their building-up work during that period.

Progressive conditions during this month, let it be repeated, will assist the bees in their preparation for winter. It seems likely, too, that in most districts sufficient natural stimulant will be obtainable from the fields to allow of progressive brood raising to be carried on and for the colonies to provide the necessary stores. In addition, it is expected that a fair quantity of surplus honey will be available for extraction. There are, however, a number of districts where no prospects are offering, and where the bees have already experienced trying times. If a supply of pollen is available in these districts, the effect of artificial stimulation by feeding to induce brood rearing should be of much value. Without a supply of pollen there is not much chance of getting the bees to raise the desired quantity of brood—our artificial pollen substitutes are not of much value for obtaining young bees to weather the hardships of winter and early spring. The best procedure where conditions

are so adverse that neither nectar or pollen is available is to temporarily remove the colonies to a locality offering brighter prospects. In many cases it should only be a matter of transportation of a few miles.

The Future of Bee-farming.

Although the bee-farming business is small compared with such industries as wool and wheat growing, the practical and observant man cannot but appreciate that with reasonable encouragement the industry has great possibilities. Drought occasionally gives the industry a set-back, but drought has not permanently crippled our other big industries, neither will it prevent the expansion of bee-farming. Granted cheap freight and fast transport, and a keen capacity to observe the prospects in different districts, a bee-farmer could be secure against drought or even an off-season. Let us illustrate the point. During the abnormal inland drought experienced a few years back, there was ample forage in the vast forests of the North Coast to supply the needs of all the bees in the State, and during the worst season inland as much as 120 lb. of surplus honey per colony could have been harvested. While the coastal districts are not the best for permanent location of apiaries, they offer great facilities for migatory bee-farming. When inland districts are drought-stricken, conditions in coastal areas usually offer a chance of saving bees, and in most cases sufficient surplus would be gained to pay for the work of transportation. Again, conditions will vary vastly in the inland districts themselves. This season, for instance, a fair number of inland apiarists have experienced the best season they have had for a number of years, while in the majority of other localities it has been an off-season.

Another matter which demands attention if the industry is to attain its proper status is the insurance to bee-farmers of some security of tenure. We have already gained one important step in this direction by the granting of permits for bee ranges on State forests, and more advantage will be taken of this privilege as the industry is built up. The matter of bee ranges or bee-flight areas over other Crown lands and private property offers many obstacles at present, but these will no doubt eventually be overcome, for it is not necessary that the actual apiary site be on the land, or that the owner or lessee be prevented from keeping bees. Bee-farmers would be prepared to pay for bee-flight areas providing some security of tenure is given. At the present time a man making his living at bee-farming may select a site and place his apiary on it, and put up the necessary buildings, &c., only to find later that another apiarist has decided to place a large number of colonies quite close to his site. It then becomes a matter of seeing who is going to move or be starved out first. There is a moral law amongst bee-farmers that one will not encroach on the other, but we find there are cases when this law is disregarded.

If half the nectar secreted by plants in a good season in New South Wales was gathered by bees the value of the crop would perhaps exceed that of the wool production. We may never have sufficient bees to gather half the nectar secreted, but we should look forward to the time when the present surplus will be greatly increased.

The Question of Markets

In any effort to bring about an expansion of the bee-farming industry the matter of markets for the product is of vital importance. It would obviously be of little value to produce an article of which we could not dispose, though bee-farming is by no means the only primary industry faced with the problem of finding bigger markets. Finance, of course, is the great difficulty, but we cannot overlook the fact that our national welfare and development is largely dependent upon the welfare and development of our primary industries, and the cost of their development would seem therefore to constitute a rational investment. What a great thing it would be if we could say to primary producers generally: There is an assured and profitable market for all that you can produce. It would inspire the producer to better methods generally. Poor market prospects often breed slackness and the train of troubles that inevitably follow slackness. A glance at our position on the map shows that there is plenty of scope for the exploitation of markets for our produce. This matter of markets is not a problem for one man, nor a problem for one section, but one calling for the whole-hearted attention of all engaged in the primary industries.

AN APICULTURAL INQUIRY.

THE statement that there exist species of bees that neither sting nor swarm, prompted a correspondent to inquire of the Department (1) if the statement was indeed based on fact, and (2) if so, where could a hive of such bees be procured. The writer was informed that although there are such species, they are distinct from our honey bees (*Apis mellifica*) and of no commercial value. All strains of honey bees will sting and swarm. Pure strains of Italian bees are usually gentle when manipulated, and are not disposed to swarm if sufficient accommodation is provided in the hive.—W. A. GOODACRE, Senior Apicultural Instructor.

DAMAGE BY FRUIT BEETLES.

"I AM forwarding some weevil-like insects which have attacked peach, nectarine, and plum trees. They bore a round hole, chiefly near the stalk, when the fruit is ripening—not before. Wherever they work inside the fruit turns a very dark-brown, nearly black, and the fruit nearly always falls to the ground. What are these insects and what procedure should I adopt for their eradication?"

The insects forwarded were a species of small beetles known by reason of their habits, as fruit beetles; they belong to the family *Nitidulidæ*, the species being *Carpophilus aterrimus*. It is the habit of the beetles to lay their eggs in decaying fruit, and to nibble the surface of fruit about the base of the stalk, causing the fruit to drop. Where fruit is open at the stalk, as in the case of certain sorts of peaches, the beetles make their way in and feed round the stone. The best way of getting rid of them is to clear up all decaying matter, for in that they lay their eggs, and in it the larvæ feed.—W. W. FROGGATT, Government Entomologist.

Orchard Notes.

MARCH.

W. J. ALLEN and W. LE GAY BRERETON.

Harvesting and Grading Apples and Pears.

IN the apple and pear growing districts some growers will still be busy preparing their oversea shipments. In previous notes this year hints have been given as to picking and handling fruit.

Pears for export should only be packed in single-layer trays.

The chief points in grading apples are size, colour, freedom from disease, and uniformity throughout every case.

The export market generally demands a good, clean, medium-sized fruit, 2½ inches being about the ideal, as the buyer generally wants what to the trade is known as a "good count." Extra large fruit is not desirable, as these are generally coarse, and do not keep so well. As a general rule three sizes are shipped (2½, 2¾, and 3 inches). but with varieties such as Jonathan, that have good colour and do not run large, it will pay to ship 2¼ inches. When grading, any fruit which shows the slightest sign of disease should certainly be thrown out.

Although it is the practice in this State to grade and pack direct from the bench, a crop that is rather badly infested with moth should first be hand-sorted, as no matter how skilful the packer, if much "mothy" fruit is on the bench, then some "mothy" fruit is sure to be packed.

Great care should be exercised when handling fruit, whether picking, sorting, or packing, to avoid damage by the finger nails. This damage is often not apparent when first done, but as the edges of the wound dry it is easily seen and when opening up packed fruit the tell-tale crescent-shaped cut in the skin is only too common. It is, therefore, important that those engaged in handling fruit during any of the operations should keep their finger nails trimmed very short. It is better for pickers and sorters to wear a glove, though packers would then probably find difficulty in handling the wrapping paper.

Branding for Export.

In order to avoid delays at the port of destination it has been arranged by the English agents to adopt distinguishing numbers, and it is trusted that all exporting this season will adopt this method. It is a decided advantage for branding to be uniform, and the accompanying specimen, which complies with both the regulations under the Commerce Act and the wishes of importers, will perhaps be of use.

The specimen is designed to suit the end of the Canadian bushel case, 11$\frac{1}{8}$ inches by 10 inches.

Some rearranging of the lettering would be necessary for our other export case, which has an end 14$\frac{1}{4}$ inches x 8$\frac{5}{8}$ inches, but it must be borne in mind that the regulations of the Commerce Act in reference to size of letters must be complied with. These provide that the name of the grower shall be in 1 inch letters, the address in $\frac{1}{2}$ inch, Australia 1$\frac{1}{2}$ inches, 1 Imperial bushel apples $\frac{1}{2}$ inch, and the name of the fruit and size 1 inch.

11$\frac{1}{8}$ inches.

10 inches.

JOHN SMITH

PENROSE, NEW SOUTH WALES

AUSTRALIA

330

1 IMP. BUSHEL APPLES, JON. 2$\frac{1}{2}$

The importing firms advise 4-inch numerals for the agent's number. This can be adhered to on cases, but will have to be reduced to suit the ends of pear trays. It should, however, be kept as large as possible so as to be easily legible to the lumpers, who are often not used to reading quickly.

The other particulars, excepting "1 Imperial bushel," which is to be omitted, will have to be placed on the top of the pear tray.

In long distance travelling, such as is entailed in exporting, it is necessary to pack fruit rather high so as to allow for the settling and shrinkage that takes place, and it is important that both the bottoms and tops of export cases be cut fine enough to allow them to spring without bringing too much pressure on the fruit. When nailing, whether in a press or otherwise, the case should only be supported at the ends so that the bottom can spring simultaneously with the top or lid.

As it is necessary to pack apples with some spring or bulge, great care should be taken when the fruit is either waiting for consignment or during transit to stack it off the bulge. Neglect of this precaution is the cause of a great deal of fruit arriving in bruised condition. Of course, as pears are packed in single-layer trays, there is no spring or bulge. In the latter case, wood wool, or corrugated cardboard must be used to take up any space between the depth of the tray and the diameter of the fruit. It should hardly be necessary to say that apples and pears for export should be wrapped in tissue paper.

Preparation of Land for Planting.

Those intending to plant fresh areas this season should have the clearing done in ample time, and the ground broken up as long as possible before the planting season. Allowing it to lie in fallow in this way gives it an opportunity of catching and holding the rains which, it is hoped, will fall shortly.

Pests.

Apple and pear growers should be reminded that it does not do to neglect the codlin moth during this very busy time.

The very dry period which we have been experiencing has prevented scale pests on citrus trees being dealt with, and this work cannot be carried out until the trees have benefited sufficiently after rain. As fumigation is more effective than spraying on the more matured scale, it will be advisable wherever possible to use the former method, as treatment has necessarily been delayed.

"Cyclopedia of Hardy Fruits."

The object of this work, which runs into some 370 large, well-illustrated pages, is to describe the hardy fruits grown in North America. Other books of the kind there have been—and of indubitable value in their day—but they are old now, and many of the varieties they describe have been superseded by modern ones, while few of the kinds popularised within the last ten or twenty years are even named in them.

The author of this work, Dr. U. P. Hedrick, is Vice-Director of the New York Agricultural Experiment Station, and he has already a reputation among horticulturists that carries an assurance of an extensive and sympathetic regard for any pomological subject. His objectives have been, briefly, to aid the identification of varieties and the choice of the ones to grow, to assist in the solution of the nomenclature problem, to indicate the regions best suited for each kind, and generally to stimulate the desire among orchardists to grow the best. The book has been written for students, growers, agents, and buyers, and generally for all interested in the subject.

The plan of this book is exceedingly simple, the eight different parts being devoted to the pomaceous (apple, pear, and quince), drupaceous (apricot, cherry, peach, and plum), grapes, brambles, currants and gooseberries, heath (cranberry and blueberry), strawberry, and miscellaneous (persimmon, pawpaw, &c.). The method adopted has been to discuss the botany of each fruit in a group first, and then to turn to a detailed description of each variety. The scope of the subject is indicated by the statement that probably not less than 2,500 apples alone have been named and described in America, though apparently only some 200 to 300 are actually grown on any appreciable scale. In fact, "the number of apples under cultivation annually grows less." Descriptions of something like 300 apples nevertheless appear here, and every other fruit has been as faithfully dealt with. The book is of real value to those who have to handle a large number of varieties.

Our copy from the publishers, The Macmillan Company, New York.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	Mar. 6, 7, 8
Orange A. and P. Association	G. L. Williams	" 6, 7, 8
Manning River A. and H. Association (Taree)	R. Plummer	" 6, 7, 8
Yass P. and A. Association	E. A. Hickey	" 7, 8
Tumut A. and P. Association	T. E. Wilkinson	" 7, 8
Bangalow A. and I. Society	W. H. Reading	" 7, 8
Hunter River A. and H. Assoc. (West Maitland)	J. S. Hoskins	" 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	" 8, 9, 10
Blacktown A. Society	J. McMurtrie	" 9, 10
Rydal A. H. and P. Association	S. B. Prior	" 10
Coramba P. A. and H. Association	H. E. Hindmarsh	" 13, 14
Mudgee A. P. H. and I. Association	S. H. Somerville	" 13, 14, 15
Quirindi P. A. and H. Association	Geo. Curtis	" 13, 14, 15
Cumnock P. A. and H. Association	K. J. Abernethy	" 14
Cobargo A. P. and H. Society	T. Kennelly	" 14, 15
Cooma P. and A. Association	C. J. Walmsley	" 14, 15
Macleay A. H. and I. Association (Kempsey)	R. T. Tarrant	" 14, 15, 16
Eden Exhibition Society	H. P. Wellings	" 16, 17
Camden A. H. and I. Society	G. V. Sidman	" 16, 17
Batlow A. Society	C. S. Gregory	" 20, 21
Tamworth P. and A. Association	F. G. Callaghan	" 20, 21, 22
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	" 21, 22
Walcha P. and A. Association	A. D. Murchie	" 21, 22
Bellinger River A. Association (Bellingen)	J. F. Reynolds	" 21, 22, 23
Royal Agricultural Society of N.S.W.	H. M. Somer	Mar. 28 to Ap. 4
Urbenville A. P. H. and I. Society	C. C. Wood	Apr. 4, 5
Lidcombe Branch Agricultural Bureau	J. M. Macey	" 7
Richmond River A. H. and P. Society (Casino)	P. M. Swanson	" 10, 11, 12
Bulladelah Agricultural Bureau	F. Coleman	" 12, 13
Wellington P. A. and H. Society	A. E. Rotton	" 17, 18
Moree P. and A. Society	C. G. Hobbes	Apr. 17, 18, 19
Upper Manning A. and H. Association (Wingham)	D. Stewart	" 18, 19
Clarence P. and A. Society (Grafton)	L. C. Lawson	" 18 to 21
Warialda P. and A. Association	Lanagan Bros.	" 24, 25
Ulmarra P. and A. Society	R. N. Shaw	" 25, 26
Dungog A. and H. Association	W. H. Green	" 25, 26, 27
Dubbo P. A. and H. Association	F. Weston	" 26, 27
Coonamble P. and A. Association	J. C. Wilson	May 1, 2
Maclean P. and A. Society	R. D. Munro	" 2, 3
Narrabri P. A. and H. Association	E J Kimmorley	" 2, 3
Hawkesbury District Association (Windsor)	H. S. Johnston	" 3, 4, 5
Junee P. A. and I. Association	T. C. Humphrys	Aug. 21, 22
Murrumbidgee P. and A. Association (Wagga)	F H Croaker	" 28, 29, 30
Qulcairn P. A. H. and I. Society	L H. M. Newton	Sept 4, 5
Young P. and A. Association	T. A Tester	" 4, 5, 6
Holbrook P. A. and H. Society	J. S. Stewart	" 18, 19
Gunnedah A. and P. Association	T. S. Henderson	" 18, 19
Northern A. Association (Singleton)	J T McMahon	" 20, 21, 22
Narrandera P. and A. Association	W. H. Canton	Oct. 4, 5

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VOL. XXXIV. PART 4. APRIL 1, 1923.

Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

WHEAT AND OAT EXPERIMENTS, 1922.

North-western District.

MARK H. REYNOLDS, Senior Agricultural Instructor.

THE farmers who co-operated with the Department in conducting cereal experiments during 1922 were:—

- L. Latham and W. King, Baan Baa.
- R. A. Studd, Boggabri.
- N. Campbell, Curlewis.
- W. Tonkin, Delungra.
- Mrs. M. A. McDonald, Gunnedah.
- H. Sternbeck, Inverell.
- J. Piper, Jr., Llangothlin.
- Bignold Bros., Manilla.
- W. Palmer, Narrabri.
- J. T. Maunder, Pallamallawa.
- J. Perry, Quirindi.
- J. Chick, Tenterfield.
- J. Davis, Wee Waa.
- V. Rolfe, Inverell
- W. Lye, Loomberah.
- Newnham Bros., Wee Waa.

Owing chiefly to faulty germination and death of a large percentage of the young plants, the plots at Gunnedah, Manilla, Pallamallawa, Baan Baa Tamworth, and Tenterfield were abandoned for record purposes. Insufficiency of moisture to maintain the young plants after germination resulted in a very thin uneven stand of the several varieties at these places, and the spaces in the majority of the plots were filled by wild mustard, trefoil, wild oats and other weeds. Although the results were not comparable, grain was harvested at two places; at others re-sowing was resorted to and feeding off and hay was made at two others.

RAINFALL Record.

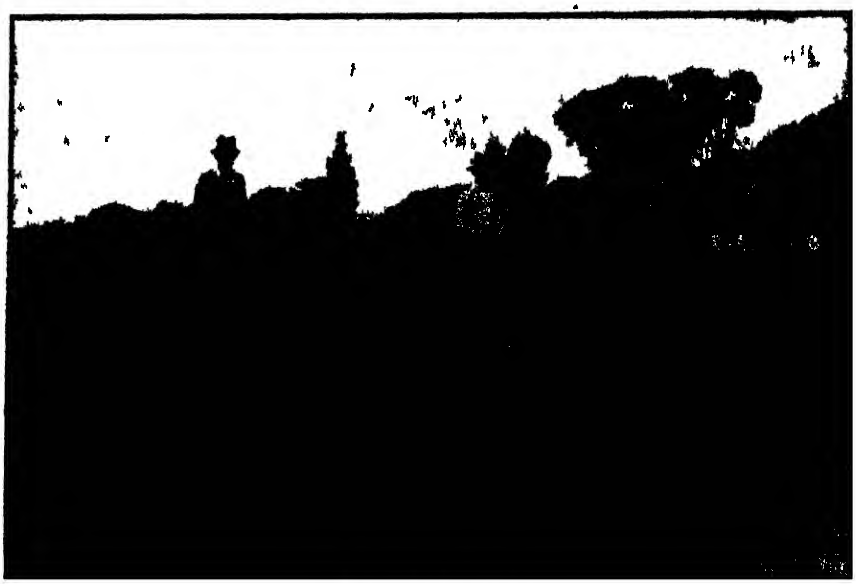
	April	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Total.
	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.
Inverell	...	..	100	380	50	290	100	...	920
Delungra ...	...	...	156	289	45	311	83	none to 21st.	884
Narrabri ...	...	8	237	297	21	298	150	...	1011
Quirindi... ...	...	...	50	370	20	300	168	83	991
Wee Waa ...	...	60	225	259	15	386	134	...	1079

A

Cultural Details.

Inverell.—Plots situated on upland, undulating, red loam country. Previous crop, wheat in 1921 (no manure) Land ploughed 5 inches deep at the end of February, 1922, and shallow ploughed 2½ to 3 inches deep (except the plot of Major, which was again ploughed 5 inches deep) just prior to sowing, and then harrowed. Major variety was sown on 18th May, and the balance on 24th and 25th May. The grain was sown with the disc drill at the rate of 42 to 52 lb. to the acre, together with superphosphate at the rate of approximately 52 lb. per acre, with check plot unmanured.

A satisfactory germination and plant stand resulted in all but the Major plot. The vacant spaces in this were filled with wild oats, etc. The crop ranged from 3 feet to 3 feet 6 inches in height. All varieties stood up well and made even growth. Small patches apparently affected with take-all were observed. Bunt was noticeable in the plots. Plump good quality grain was harvested.



The Plot of Florence at Inverell.

Delungra.—Experiments located on slightly undulating upland country with dark chocolate to black clay loam soil. Previous crop, wheat (unmanured) 1921 Land ploughed about 17th March, 4 inches deep with mouldboard plough, and a week later harrowed once. It was in a dry, crumbly, weed-free condition when it was skim-ploughed about 2½ inches deep on 16th May. The seed was not treated in any way and was sown in a very dry seed-bed, together with fertiliser, with the grain drill on 16th and 17th May. The approximate rate of sowing was seed 50 lb. and superphosphate 40 lb. per acre. Good germination and plant stand resulted. The deficiency of rainfall in August and especially in October affected the growth. On 25th October, in the plots sown with Bomen and Major, the tips of the ears were

more or less blighted, the latter being the more affected. These varieties were surrounded by others not so affected, and the damage was therefore possibly due to dry weather, and indicates a liability of these varieties to damage by such dry periods as those that occurred this season. Queen Fan was also more less tip-blighted, but as the plots of this wheat were on the remote western end of the area with the lowest altitude, and as frost occurred on the flat and low-lying portions of the district about the time of ear formation and early development, the damage may have been due to that. The blighted tip was sufficiently serious—in some instances one-third of the ear was bleached and empty of grain—to materially affect the yield. The plots were very free from weeds. All varieties stood up well and were free from disease. Growth ran from 2 to 3 feet, Florence and Canberra reaching the latter height. Plump and heavy good quality grain was generally harvested.

The Plot of Clarendon at Wee Waa.

Wee Waa (Wheat Variety Trial).—Plots located on almost level country, soil a red sandy loam. No crop had been sown on the site since 1915, but it had been cropped previously to that. The land was disc ploughed in November, 1921, 4 inches deep, springtooth cultivated in December, cross-ploughed (disc) 4 inches deep in February, disc ploughed 4 inches in March, and finally springtooth cultivated about a week prior to seeding. The area of each plot was approximately an acre. The seed was treated with 1½ per cent. bluestone solution for bunt prevention; drilled in a seed-bed where the moisture was showing and which, supplemented by 60 points rain on 12th May, proved sufficient to promote a satisfactory germination and plant-stand. No fertiliser was applied, chiefly because a suitable fertiliser drill was not obtainable.

The seed was sown on 1st May, at the rate of 52 lb. wheat, 21 lb. to 32 lb. oats. The deficiency of rain in August especially, together with conditions favouring evaporation, had no material effect on this crop. It remained healthy and vigorous throughout. Clarendon was the first wheat to appear, and in the early stages was markedly vigorous. All varieties of oats and wheat stood up well, the wheat attaining a height of 3 feet 6 inches, and the oats (Sunrise) 5 feet. A section of Mulga oats was inadverently sown at the rate of 75 lb. seed per acre. which was apparently too heavy sowing for the soil and season; about 36 lb. per acre would have been satisfactory. With the exception of Algerian oats, the several varieties of wheat and oats were harvested with stripper harvester about the first week in November. General freedom from disease and good quality grain was harvested.

The rainfall through the Wee Waa district was very patchy, and this, together with the great variation in soils, partly accounts for the yields throughout the district varying from 2 to 40 bushels per acre.

Wee Waa (Wheat Manurial Trial).—A trial was conducted by Mr. J. Davis with wheat sown on land that in the previous (1921) season had produced a crop of Florence variety which was badly affected by take-all (*Ophiobolus graminus*) or foot-rot (*Helminthosporium*).

The land had been cropped four years with wheat. In preparation for the 1922 experiment crop it was ploughed in January and February 5 inches deep, and was one-way disced in May, just prior to seeding. The variety sown was Bomen and a magnificent crop resulted—very even, about 4 feet high, not affected with disease, and yielding good quality grain. About 8 inches of rain fell during the growing period.

Narrabri.—Plots located on upland soil, very sandy in nature; country sloping to south and west, and of the poor Pilliga-scrub class. The land was cropped in 1921 with rape, except on portion which was sown to Skinless barley and mangolds. Finely-ground rock phosphate was applied with the 1921 crop at sowing at the rate of about 56 lb. per acre. The fodder crops were fed off by sheep chiefly, and a few pigs from time to time. The cultivation for the experimental area consisted of a ploughing about 25th January, 4 inches deep, and 15th March, 5 inches deep, and the greater portion was again ploughed 5 inches deep, as couch was prevalent. It was then harrowed, the heaps of couch burnt, and pigs again turned in to reduce couch and nut grass until sowing time. The drill was run over portions roughed by pigs before seeding. The difficulty of ploughing a uniform depth is met on all classes of soil. On this plot the effort to keep both plough and drill from going too deeply was not successful. The area sown to each variety was generally about an acre. The seed was sown with the wheat drill at the rate of about 55 lb. per acre with superphosphate at the rate of 56 lb.

The sowing was made on 3rd May, plenty of moisture for good germination showing at about 4 inches deep, where some of the grain was deposited, but not sufficient at 2 inches, the depth at which it was desired to sow. This unevenness in depth of sowing resulted in portion of the crop germinating and developing in a few days, while other portions did not appear for

over a month following the June rains; and as the crop was on the thin side, easily noticeable on account of poor stooling, a considerable quantity must have malted in the soil and died. About mid-July the crop was fed off by sheep for three days. It was considered advisable not to harrow the crop, as the soil was very open and loose. On 31st August the early germinating portions of the early varieties were coming into ear. Penny was 2 feet high and Major 15 inches, and just coming into ear when the balance were 3 to 3 feet 6 inches high, well in ear, and almost mature. All varieties stood up well, and no disease was apparent. The grain was plump and of good quality, except Major, which was pinched. The plots were harvested with the stripper harvester about 17th November (although some were fit earlier) with the exception of Major, which was harvested on 20th, with some few heads not quite fit.

Quirindi.—Plots located on slightly undulating upland country, the soil being a red to chocolate coloured, free working loam. A wheat crop (without manure) was harvested off the same land in 1921, and it had been cropped previously. The entire cultivation for the experiment following the preceding wheat crop, after raking the straw and burning same, was two cultivations with the springtooth cultivator to about 3 inches deep. The area of each plot was about an acre. No treatment for rust prevention was given the seed, and the resultant crop was apparently free from this disease. The seed was sown in a dry seed-bed on 2nd and 3rd June, at the rate of 46 to 59 lb. per acre, together with superphosphate at the rate of 40 lb. per acre. A good stand resulted although stooling was deficient. The crop was practically free from rust or other disease. All varieties stood up well, and the quality of grain harvested was good.

Llangothlin (Oat Variety Trial).—The crops in this section of the district being late manuring, the yields are not available for this report. The varieties Sparrowbill and White Giant were imported from Tasmania and tested against White Tartarian, the variety most generally grown on the top (Black Mountain to Ben Lomond). They were sown on red to chocolate basaltic loam from 11th to 15th September, the seed and superphosphate being broadcasted at the rate respectively of 1½ bushels and 84 lb. per acre. For the two previous years the land was cropped with potatoes, manured with superphosphate in 1920, and unmanured in 1921.

The preparation of the land for the experiment consisted of nothing further than that given by the fork digging of the potatoes and the ploughing in of the oats. On an inspection on 16th January it was noted that where the rows of potatoes had been the oat seed was more mature. All varieties were about 4 ft. high, with good promise of good quality grain, the order of maturity being—Sparrowbill, White Tartarian, and White Giant.

Inverell (Oat Variety Trial).—Plots were located on upland black clay loamy soil of basaltic origin, slightly sloping to the west. The section of land was not cropped in 1921. Maize was sown in January, 1922, but failed. No manure was applied on this occasion.

A 4-inch mouldboard ploughing at the beginning of September, 1921, and again the same depth early in December, and the ploughing in of the seed maize in January, 1922, was followed by a 2½-inch ploughing during the last week in March. This put the soil in very good condition, and a store of moisture was available for future contingencies. The nature of the soil is such, however, that the moisture penetrates and becomes distributed to greater depths than is advantageous in dry seasons. Superphosphate at the rate of 56 lb. per acre was broadcasted on the plots on 16th May, and the seed was sown from a seed-box on the springtooth cultivator at the rate of 1½ bushels to the acre. Faulty germination resulted in a somewhat thin plant stand. Wild oats subsequently filled these spaces. On 9th August the growing crop was harrowed. The yields per acre of hay were as follows:—Guyra, 1 ton 9 cwt.; Sunrise, 1 ton 2 cwt. 3 qr.; Algerian, 1 ton 2 qr.; Algerian (unmanured), 1 ton 3 qr.; Mulga, 16 cwt. 3 qr. The order of maturity was—Mulga, Sunrise, Guyra, and Algerian. The prospects and showing were for good quality grain.

RESULTS of Wheat Variety Trials.

Variety.	Inverell.	Delungra.	Wee Waa.	Narrabri.	Quirindi.	Variety.	Delungra.	Wee Waa.	Narrabri.	Quirindi.
	bus.	bus.	bus.	bus.	bus.		bus.	bus.	bus.	bus.
Major	17	12	..	9	22½	Queen Fan ...	11	...	...	...
Currawa	27	17	...	...	24⅝	Clarendon ...	...	17¾	...	17¾
Bomen	26½	11¾	22¾	12	...	Warren	...	26¾	...	24½
Waratah	25½	15	...	12	26⅓	Gresley	...	21⅓	13	...
Canberra ..	26	16	22½	...	25	Imp. Steinwedel	...	19	10⅓	...
Florence	20	15	15	..	19⅓	Penny	...	...	11	...
Comeback ...	21¾	...	.	..	...	Hard Fed. ...	...	...	...	...

RESULTS of Wheat Manurial Trials.

Plot and Variety.	Superphosphate, per acre.	Bushel Yield, per acre.		Remarks.
		Manured plot.	Unmanured plot.	
	lb.			
Inverell (Comeback) ...	52	21¾	19½	Harvested 28th November.
Delungra (Queen Fan) ...	40	11	12	Harvested 22nd November, and 5th December.
Narrabri (Bomen) ...	56	12	17	Not comparable, as the preceding crop was different.
Quirindi (Clarendon) ...	40	17¾	19¾	....

An oats variety trial at Wee Waa resulted in the following yields:—Mulga, 20 bushels per acre; Sunrise, 25½ bushels; Guyra, 35 bushels.

General.

The necessity in many instances for replanting, owing to faulty germination and a too thin distribution of plants, was a feature of the wheat season in the north-west in 1922. Where the land had been cropped with cereals or pasture the previous year and broken in the autumn, culivation demanded increased labour and gave less satisfaction than in normal times, owing to deficient rainfall in the autumn, the result being a dry seed-bed.

Where fallowing for a longer period had conserved some moisture, the moisture content for the proper seeding time (April and May) was often insufficient to maintain the germinated seed, except where fallowing had been thoroughly done on soil holding its moisture chiefly near the surface. Farmers were advised to sow seasonably if the seed-bed was dry, or, if, in their judgment, the moisture was sufficient to maintain the young plant into the winter. Generally the rainfall upset calculations, and the farmers who scored best were those who had the land ploughed but awaited good rain before sowing. This occurred in June, and a large area was sown in June and July.

More often than otherwise sowing in a dry seed-bed has been safe in past years.

Medium late maturing varieties of wheat such as Bomen, Currawa, Yandilla King, and Marshall's No. 3, scored this season owing to the late spring rains, whereas early maturing varieties in many instances had reached a maturer stage, and hence received less benefit.

There were outstanding instances of the benefit of fallowing, to mention two—those of Messrs. J. B. White & Sons, Boggabri, and Messrs. Newnham Bros., of Wee Waa. Another feature of the season was the absence of noticeable damage from foot-rot fungus. Take-all was prevalent to a minor extent on areas seen. Loose smut was fairly prevalent, especially in Canberra wheat at Boggabri. Flag smut was only noticed in one place, and rust was but rarely seen.

The grain harvested was generally f.a.q., and little difficulty was experienced in harvesting either wheat or oats even up to 4 feet high, as the crops stood up well.

The wild mustard weed was much in evidence throughout the north-west in the wheat-fields, especially in a thin stand of wheat.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Senior Agricultural Instructor.

DURING the season, 1922, the following farmers co-operated with the Department in conducting wheat trials for grain:—

T. C. Davies, "Parkside," via Leeton.
E. McKenzie, "Brobenah," Leeton.
*J. S. Leitch, "Glenlee," Leeton

Previous to sowing a dry spell was experienced, which was broken by good rain on 25th April, when over 2 inches were recorded. Following this fall, registrations of under an inch were recorded for the months of May and June. Six frosts were registered during September, that on the 22nd being the most severe—30·3 degrees Fah.

Good yields were obtained, but may be attributed to the fallowing carried out during the previous twelve months. The crops received very little rain during the critical period of growth, and hot, dry weather with strong winds was experienced during October and November.

The rainfall records were as follows:—

May, 77 points; June, 78 points; July, 154 points; August, 127 points; September, 109 points; October, 88 points. Total, 633 points.

All the crops were very free from disease, only an isolated case of flag smut being noted. Of the new varieties tried, Gresley appears to be suitable to the district; it should be especially useful for sowing headlands in place of Firbank, being a much better stooler, stronger in the straw, and practically as early as Firbank. Clarendon showed to great disadvantage, being weak in the straw.

Notes on the Plots.

"*Parkside.*"—The plot consisted of red sandy loam. It was fallowed in September, 1921, disced in October, springtoothed in April, and again before drilling on 11th May, after which the land was harrowed. The rate of seeding was 45 lb. per acre, and superphosphate was also applied at 45 lb. per acre. The seed used in all the plots had been pickled in a 1 per cent. solution of bluestone. All the varieties gave a good germination. Clarendon made very rapid growth. Gresley also did very well and showed promise right through. Both Firbank and Clarendon proved to be weak in the straw, and were badly damaged by the heavy winds in October and November, which resulted in much of the grain being lost. Marshall's No. 3 gave a good return, but suffered from the hot winds, many of the ears being half empty.

"*Brobenah.*"—Sown on a red loam on 10th May. The land had been fallowed during the spring of 1921, cultivated in January, 1922, and again before drilling; the same rates of seed and of manure were adopted as in the other plots. Good germination resulted, but the weeds also came badly. Yandilla King was the thinnest stand, but gave the heaviest return; Bomen showed the effects of the late frosts, the flag becoming discoloured. Sparrows were very bad on the plot of Gresley, and helped materially to reduce the yield

"*Glenlee.*"—The plots here were sown on red pine country that had been fallowed in the winter of 1921, cultivated in spring, and again before drilling on 15th May; the land was harrowed after drilling. Fair to good germination was obtained. Very heavy weed growth was made, which greatly reduced the yields. Gresley showed to advantage throughout the trial.

The yields were as follows:—

	"Parkside."		"Brobenah."		"Glenlee."	
	bus.	lb.	bus.	lb.	bus.	lb.
Bomen	25	42	29	32	18	20
Gresley	25	37	25	29	20	37
Federation	23	51	27	24	15	43
Marshall's No. 3	23	28	29	14	......	
Penny	22	42	......		......	
Imperial Steinwedel ...	21	33	27	0	15	20
College Purple	21	30	......		16	30
Currawa	21	8	......		17	14
Clarendon	15	35	......		......	
Firbank	12	15	......		15	0
Yandilla King	......		30	13	.....	
Zealand	......		24	43	......	
Hard Federation	......		24	1	14	
Warren	......		22	44	......	

Dreadnought Boys.

The Department, acting in conjunction with the Immigration Department, is training Dreadnought boys on certain of the experiment farms. These boys are of a very fine class, having been specially selected in Great Britain with a view to their suitability for agricultural employment. On arrival in New South Wales they are trained for six months in all branches of farm work, such as ploughing, milking, orchard work, &c., and at the end of this period they have become very useful as farm workers. Farmers who have employed boys trained under this scheme have been very pleased with them. The boys receive their training at Wollongbar, Grafton, Cowra, and Glen Innes Experiment Farms, and inquiries may be addressed to the Managers of those farms or to the Director of Immigration, Elizabeth street, Sydney.

Water as a Vehicle for Spreading Plant Diseases.

Discussing the "damping off" disease to which tomato seedlings are subject, Dr. W. Bewley, Director of the Lea Valley Experimental Station (England), points out in a recent issue of the *Journal of the Royal Horticultural Society* (London), the significance of a pure water supply. The organisms of the fungi responsible for the disease mentioned are carried from season to season in the soil, water, seed-boxes, and pots.

"The great importance of having a pure water supply cannot be too firmly impressed upon the minds of all cultivators of plants, for all methods of sterilizing soils must be useless if copious infection is carried with each watering." Dr. Bewley describes how, in 1920, he collaborated in an extensive examination of local nursery water supplies by carefully filtering large volumes of water. "Our results showed that deep artesian wells were free from contamination, but shallow wells, brooks and ponds were frequently polluted with fungal and bacterial parasites."

Winter Schools for Farmers, 1923.

Arrangements have been made for the annual Winter School for farmers to be held at Hawkesbury Agricultural College from 26th June to 21st July next. The syllabus covers a comprehensive course of lectures and demonstrations on agriculture, horticulture, live stock, &c., and in addition, practical training is available in useful work connected with farm life, such as saddlery, engineering, blacksmithing, carpentery, &c.

To meet a popular demand, a special school will be held for those who desire to specialise in the subject of poultry-farming. All branches of the industry will be fully dealt with, and moreover, the students will be given an opportunity of studying such subjects in the general course as are likely to be of value to them.

Farmers and youths over 16 years of age who have been engaged in rural work for at least one year will be eligible for admission to the general course, and admission to the poultry course will be granted to persons of either sex over the age named who are engaged in poultry-farming.

Applications for both schools will close on 31st May, 1923.

The fee for either course, inclusive of board and lodging, will be £5 5s. Prospectus and full information may be obtained on application to the Under Secretary and Director, Department of Agriculture, Sydney.

Winter Fodders and Increased Dairy Production.

As a result of the Department's experiments with oats, wheat, peas, and vetches for winter and early spring fodder with farmers along the coast and tablelands, there has been a considerable increase in the amount of these fodders grown by dairy-farmers, resulting in greater production of dairy products during the winter, when natural pastures are mostly scanty.

These experiments have shown that the question of variety is very important, not only in relation to yield, but to rust-resistance. In the season 1920, when seed wheat was very scarce, some of the western grain varieties had to be grown, and although these did fairly well in that year, it was shown in the following season that they cannot compare with rust-resistant early varieties such as Thew, Florence, and Firbank. Sunrise oats still continue to attract attention on account of their early maturity and high yields.

On the North Coast the period of greatest shortage of green fodder is usually spring rather than winter, and it is being found that a late sowing of these cereals is better than an early sowing, as if the crops are not required for green fodder the weather is generally more suitable for making hay at that time of the year. This will, as time goes on, demonstrate to the North Coast farmer that the growing of his own hay for horse feed will be found more profitable than purchasing it, with the attendant heavy additional freight charges involved by the extreme distance from the usual centre of production.—A. H. E. McDonald, Chief Inspector of Agriculture.

Dry Treatment of Seed Wheat for Bunt.

A. H. E. McDONALD, Chief Inspector of Agriculture.

EXPERIMENTS which have been conducted by the Department of Agriculture have indicated that wheat can be effectively treated with dry carbonate of copper as a preventive against the attacks of bunt, and that the germinating powers of the seed are not reduced as is the case under some conditions when the bluestone and formalin treatments are used, and, moreover, that the seed can be safely treated a considerable time before sowing. This is a decided advantage, as the seed may be prepared before the sowing season arrives, and therefore delay need not occur through time having to be spent in treating it at that time. Owing to a machine not being available to treat large quantities of seed, it has not hitherto been possible to make extensive trials to determine whether the dry treatment would prove satisfactory under ordinary field conditions.

In the United States, particularlv in California and Washington, this treatment has attracted much attention, and in the latter State a machine has been designed and patented, which treats the grain effectively and expeditiously. The essential points of a machine designed for the treatment of wheat are:—

1. Capacity to treat the grain without exposing the operator to the poisonous and irritating copper carbonate dust, and
2. Simplicity in design, so that it can be constructed by any farmer who is handy with tools.

These are adequately provided for in the Washington machine. The design and method of operation can be clearly seen in the illustration, which is taken from a bulletin entitled "The Dusting of Wheat for Bunt or Stinking Smut," issued by the State College of Washington.

The machine simply consists of a drum mounted in a frame, three wooden slats being fitted to the inside of the drum. If the drum is made, say, 21 inches in diameter, these slats should be 5 inches wide and about 1 inch in thickness. The object of these is to lift and mix the wheat when the drum is revolved. A door is provided in the drum to allow of the wheat being run into and out of the machine. At the top of the framework a hopper is provided to facilitate the placing of the wheat in the machine.

The ratio of the sprockets is 1 to 4, there being six teeth on the drive sprocket and twenty-four on the drum sprocket. The drum is 21 inches in diameter and 36 inches in length. The total height is 5½ feet.

The wheat is emptied into the hopper and allowed to run into the drum, which is then turned slightly, so that the opening will be clear of the hopper. The carbonate of copper is then scattered uniformly over the surface of the

grain at the rate of 2 oz. to each bushel of wheat. The door is then closed and the drum rotated for two or three minutes. When the mixing is

Dry Treatment of Seed Wheat for Bunt.
The machine used at the State College of Agriculture, Washington, U.S.A.

completed, the drum is stopped with the opening at the lowest point and the wheat run into sacks ready to be carted to the drill or for storage until seeding time.

Writing to this Department, before the bulletin containing particulars of this machine was published, Mr. John Ledger, of Leabrook, South Australia, described a machine which he had designed, and with which he had treated seed for 224 acres. This machine was built on the same principle as that illustrated, except that the drum, instead of being cylindrical, was six-sided. This shape would probably be a decided advantage. He wrote:—"I reckon it is useless to cover it by patent rights, as any resourceful 'cocky' could make a contrivance to answer the purpose of thoroughly dusting the grain." No doubt one such contrivance would be an ordinary cask mounted so that it could be easily revolved.

Mr. Ledger did not place wooden slats in his drum, but these would not be so necessary in a six-sided drum.

Copper carbonate is stocked by leading wholesale chemists, but if any farmer desires to test the new treatment, he should have no difficulty in obtaining the chemical through his local storekeeper. The cost will not exceed a few pence per bushel.

The copper carbonate dust is irritating and objectionable, and the treatment should be carried out in the open, and any machine used for treating the wheat should be so constructed that dust cannot escape during the process. Copper carbonate is a poison, and therefore great care should be exercised in handling it.

To Control The Sucking Sheep Louse.
(*Hæmatopinus ovillus*).

This external parasite has made its appearance in a number of flocks in the southern and western districts of New South Wales, and is evidently well established in this State. It has for some time periodically appeared at North Bangaroo Stud Farm, despite the fact that dipping is carried out annually.

Pastoralists should keep a look-out for this parasite and endeavour to deal with infestations in their early stages. Affected sheep are infested with immense masses of eggs or nits upon the wool of the belly, legs, and thighs, and, in the case of rams, in the vicinity of the testes. When rams are badly infested in this manner the testes become greatly swollen; the animals' movements are naturally impeded, grazing is interfered with, and general uneasiness is caused.

Different makes of powder-dips were tried for several years, but the parasite still made its appearance, and the method was adopted of isolating and treating affected animals individually. After many experiments the the following mixture has been found the most effective: Sheep-dipping powder, 3 oz.; ol. terebene, 1 oz.; ol. creosote, 1 oz.; ol. citronella, ½ oz.; ol. linseed, 45 oz. This should be shaken well before use, and applied directly by hand to the affected parts. A second dressing may be necessary in odd cases, but one application is usually sufficient. It is advisable that any infested wool removed be carefully burnt.—Robert A. Patten, B.V.Sc., Manager, North Bangaroo Stud Farm.

Lamb-raising for Profit.

F. B. HINTON, Sheep and Wool Expert.

In deciding on the breed or combination of breeds most suited for lamb-raising many factors have to be considered. The final monetary return from the lambs in the saleyards and the lambing percentages are both important, but a factor which is often overlooked is the influence on the gross return caused by the loss of ewes at lambing time. The value of any breed or cross can only be assessed after a consideration of the net return; that is, after a subtraction from the account sales (of lambs sold) of the value of the ewes lost during lambing. Heavy losses in ewes at lambing time greatly depreciate the net returns, and care must therefore be taken in the selection of suitable breeds.

The type of ewe used for lamb-raising is also very important in this respect. Experience has proved that the half-bred ewe, whether Lincoln x Merino or Border Leicester x Merino, is most suitable, principally on account of good milking capabilities, and the fact that this type of ewe experiences less difficulty at lambing time when lambing to British breeds than ewes containing a larger percentage of Merino blood.

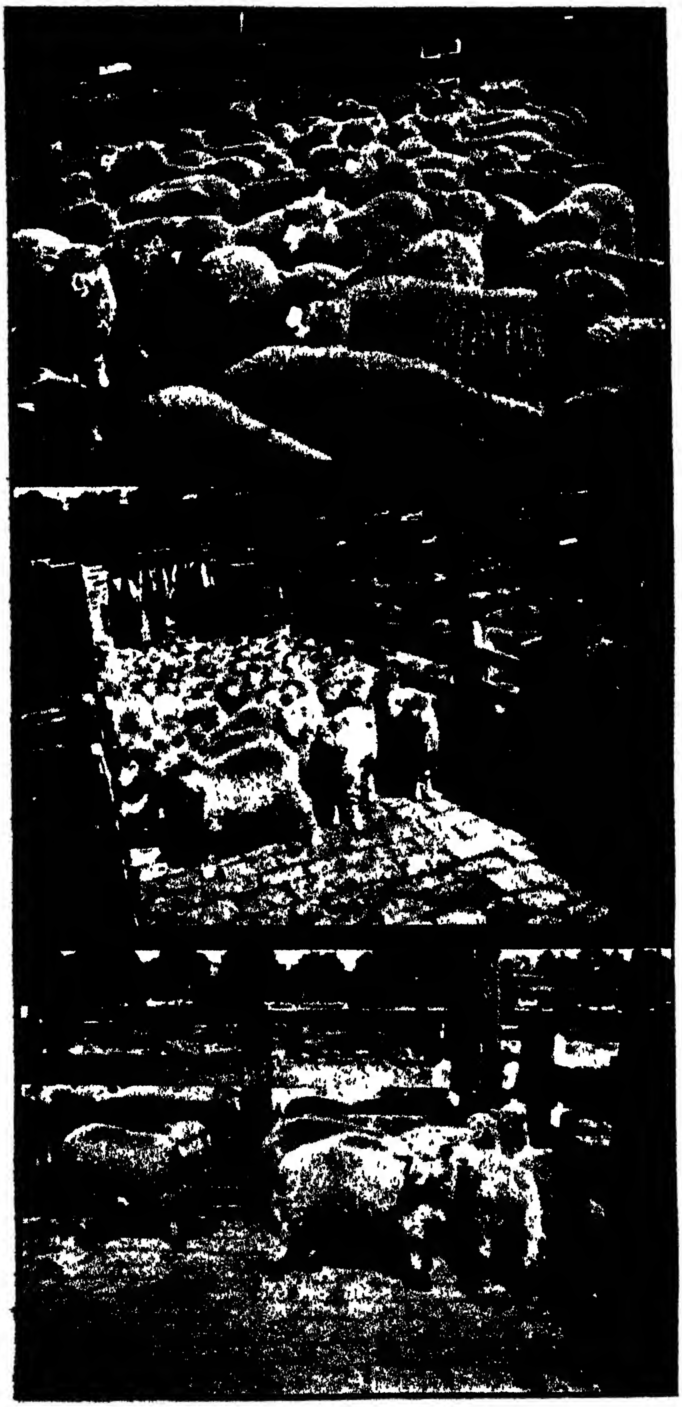
With the above objects in view tests are being carried out at Cowra and Bathurst Experiment Farms, and the results of last year's operations are appended. The combinations of breeds used were those advocated by the Department as being best for fat lamb-raising; that is, the Dorset Horn and South Down rams and first-cross ewes. In addition, the recently-imported Ryeland rams were used.

The Results at Cowra.

The ewe flock, consisting of 294 first-cross Border Leicester x Merino and Lincoln x Merino ewes of mixed ages, was divided into three separate equal flocks, and joined with rams of the South Down, Dorset Horn, and Ryeland breeds. Two rams of each breed were used.

During mating each flock was allowed access to plenty of feed and water, the paddocks in which the South Down and Dorset Horn flocks were run containing some Sudan grass. All the rams appeared to work well from the commencement of mating on 18th January, and it was not found necessary to give them any extra feed or attention. Mating lasted for six weeks, the rams being removed on 1st March, and the ewes, after being suitably branded, were boxed. No extra feed was given to the ewe flock prior to the commencement of lambing, which began on 14th June.

During lambing the ewes were run on fodder crops of oats, barley, and rye, which had made good growth, and the flocks were kept on these fodder crops, with occasional spells on natural pastures, right up to the trucking of the lambs. As a result of these favourable conditions the ewes had a plentiful supply throughout, and the lambs did not suffer the slightest check from birth until trucked.



Lamb-raising Trials at Cowra Experiment Farm.

Top, Ryeland cross lambs. Middle, Dorset Horn cross lambs
Bottom, South Down cross lambs.

The following table shows the lambing percentages of the various crosses :—

No. of ewes in flock.	Breed of lamb.	Deaths before marking.	Number of pairs of twins.	Total births.	Number marked.	Percentage marked.
98	South Down cross ...	...	...	11	11	11
98	Dorset Horn cross ...	8	12	102	94	95·9
98	Ryeland cross .	7	7	94	87	88·7

Two of the ewes mated with Dorset Horn rams died during the lambing period. The post-mortem in each case revealed the fact that both ewes were carrying twin lambs, but had not commenced to lamb.

Lamb-marking was performed when the lambs were from two to seven weeks old, and, after marking, the lambs were weighed monthly. Owing to the small lambing percentage obtained from the South Down cross, the comparison of this cross with the other two is difficult, but it may be remarked that throughout the growth of the lambs it was possible at any time to pick out the Dorset Horn cross from the Ryeland, the former being leggy while the latter were shorter and very thickset. Both these crosses showed excellent conformation throughout.

The weights of the lambs at the different weighings were as follows : —

Breed of lamb.	10th August.	12th Sept.	20th October.
	lb	lb.	lb.
South Down cross... .	26½	53	67½
Dorset Horn cross	38½	61	81
Ryeland cross . ..	33½	60	80

As this table shows, the Dorset Horn maintained its superiority in weight throughout, very closely followed by the Ryeland.

The lambs were marketed in two drafts—the first lot on 2nd November (four and a half months after the commencement of lambing), and the second lot on 13th December. Both consignments were sold at Homebush and were very favourably commented on by buyers, especially the conformation of the Dorset Horn cross. All the lambs which were marked were sold, except one Ryeland cross lamb, which died, and one South Down cross, which was unfit for sale.

The prices realised are shown in the accompanying table.

Breed of lamb.	First draft.		Second draft.		Total No. of lambs sold.	Grand average.
	No. of lambs.	Average price.	No. of lambs.	Average price.		
		£ s. d.		£ s. d.		£ s. d.
South Down cross ..	7	1 2 10	3	0 17 10	10	1 1 4
Dorset Horn cross ..	60	1 6 7	34	1 0 4	94	1 4 4
Ryeland cross	60	1 3 1	26	1 0 7	86	1 2 4

The following table shows the net results obtained from each flock, after deducting losses in ewes:—

Breed of Lambs.	Ewes mated.	Lambs sold.	Average price per lamb.	Value of lamb kept.	Ewes died at lambing.	Value of ewes per head.	Total value of lambs.	Less value of ewes died	Average return per ewe mated.
			£ s. d.				£ s. d.	£ s. d.	£ s. d.
South Down cross	98	10	1 1 4	10s.	—	25s	11 3 4	11 3 4	0 2 3
Dorset Horn cross	98	94	1 1 4	—	2	25s	114 7 4	111 17 4	1 2 9
Ryeland cross	98	86	1 2 4	—	—	25s	96 0 8	96 0 8	0 19 7

The Results at Bathurst.

Owing to the difficulty in obtaining paddocks of suitable area for mating at this farm it was not possible to have the flocks of equal size. The same percentage of rams was used, however, forty-nine ewes being mated with one South Down ram, ninety-nine ewes with two Dorset Horn rams, and fifty ewes with one Ryeland ram. The ewes in each case were first-class Lincoln x Merino, three and four years old.

The mating period was from 7th February to 22nd March. The Dorset Horn and Ryeland rams were vigorous from the start, but the South Down did not become active so quickly. During the first week of mating the flocks were yarded three times, but owing to the trouble experienced from town dogs the flocks were yarded every night afterwards throughout the year. This fact undoubtedly influenced the lambing percentage.

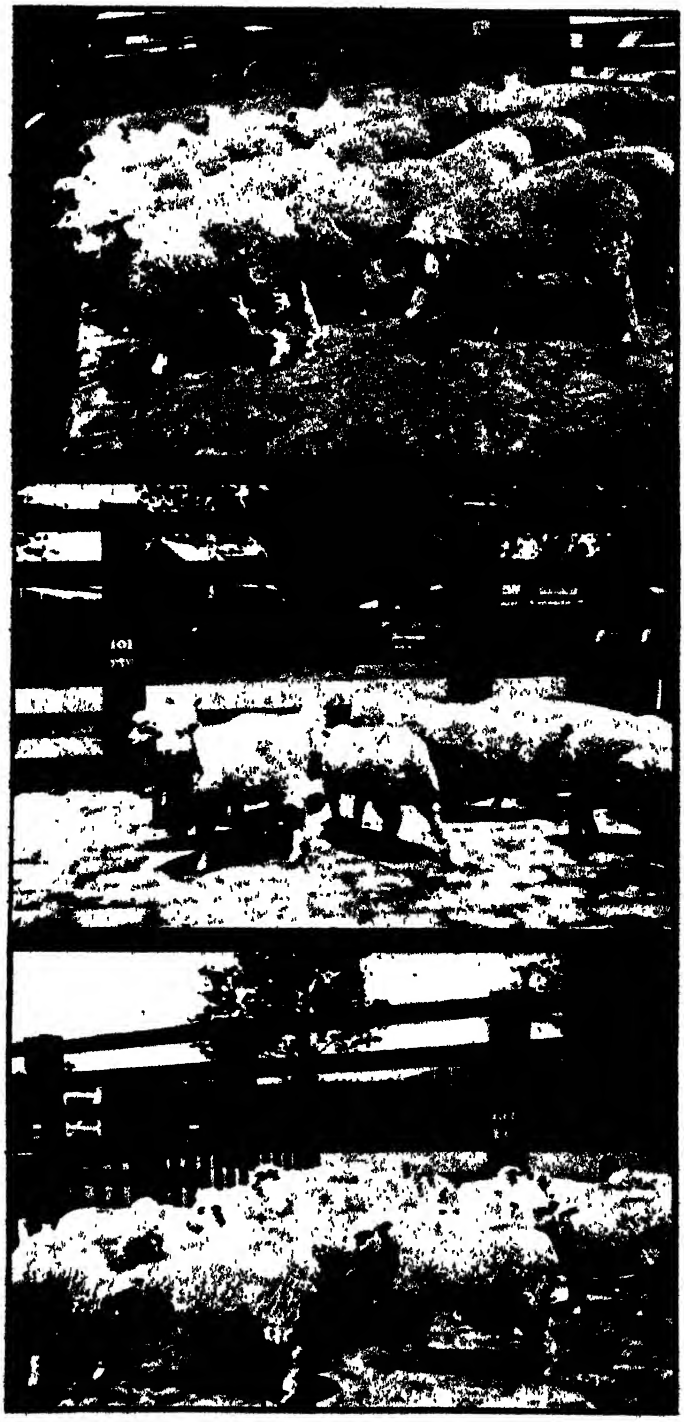
After mating, the ewes were boxed and run on stubble and bush land. Owing to the continued dry weather at this period it was found necessary to hand-feed. A ration of 2 lb. lucerne chaff, 4 lb. straw chaff, and ½ lb. linseed meal per head per day was given for about three weeks prior to the commencement of lambing, to augment the natural pastures.

A certain amount of assistance had to be rendered during lambing, and pre-parturient apoplexy accounted for several ewes of each group. Both these items were no doubt due to a large extent to,—(1) the dry conditions prevailing; (2) the yarding which took place nightly; and (3) the worrying from town dogs during the day to which the sheep were subjected on several occasions.

The number of ewes assisted were:—

Ewes mated with—	Deaths due to lambing.	Assisted.	No. of ewes in flock.
South Down rams... ..	1	4	49
Dorset Horn rams ...	3	8	99
Ryeland rams	3	4	50

Very cold weather, including a light fall of snow, was experienced during lambing, and a number of lambs died from exposure immediately after birth.



Lamb-raising Trials at Bathurst Experiment Farm.

TOP, Dorset Horn cross lambs. MIDDLE, South Down cross lambs.
BOTTOM, Ryeland cross lambs.

The lambing percentages are presented in the next table.

No. of ewes in flock.	Breed of lamb.	Deaths before marking.	Number of pairs of twins.	Total births.	Number marked.	Percentage marked.
49	South Down cross ...	6	13	61	55	110
99	Dorset Horn ,, ...	11	4	90	79	79
50	Ryeland ,, ...	9	7	52	43	86

The lambs were marked when they were between two and seven weeks old, and were afterwards weighed at intervals of one month. The following table shows the weights at the different weighings:—

Breed of lamb.	24th Aug.	20th Sept.	26th Oct.	22nd Nov.
	lb	lb.	lb.	lb.
South Down cross ...	25	37½	57	72
Dorset Horn ,, ...	35	49	75	84
Ryeland ,, ...	34½	47	66	81½

It will again be noted how closely the Ryeland follows the Dorset Horn.

The lambs were sold in two drafts—the first on 29th November, at four-and-a-half months old, and the second lot three weeks later. Except five of the South Down cross (one of which died, and four of which were too small), all lambs marked were trucked. The following table shows the prices obtained at Homebush:—

Breed of lambs.	First Draft.		Second Draft.		Total No. of lambs sold.	Grand average.
	No. of lambs	Average price.	No. of lambs.	Average price.		
		£ s. d.		£ s. d.		£ s. d.
South Down cross	15	0 18 1	35	1 3 10	50	1 2 1
Dorset Horn ,, ...	51	1 1 10	28	1 4 7	79	1 2 9¼
Ryeland ,, ...	34	0 19 10	9	1 4 10	43	1 0 10½

The following table shows the net results obtained from each flock after deducting losses from ewes lost at lambing:—

Breed of lambs	Ewes mated.	Lambs sold.	Average price per lamb.	Value of lambs kept.	Ewes died at lambing.	Value of ewes per head.	Total value of lambs.	Less value of ewes died.	Average return per ewe mated.
			£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.
South Down cross*	49	50	1 2 1	0 10 0	1	1 5 0	57 4 2	55 19 2	1 3 0¼
Dorset Horn ,,	99	79	1 2 9¼	..	3	1 5 0	97 0 1¼	93 5 1¼	0 18 10
Ryeland ,,	50	43	1 0 10½	..	3	1 5 0	44 17 7½	41 2 7½	0 16 5

* Four lambs of this cross were culled for size.

Summary.

On perusing the returns obtained from these two farms one is struck with the dissimilarity in the lambing percentages of the South Down. No reason can be assigned for the low lambing percentages of this cross at Cowra, while that obtained from the same cross at Bathurst is inconsistent with all previous lambing percentages obtained from this cross at that farm. On this point it is interesting to note that during the lamb-raising trials conducted continuously from 1913 to 1919 at Cowra, the South Down averaged 69 per cent. lambs and the Dorset Horn 73·7 per cent., while at Bathurst the same breeds averaged 88·6 per cent. and 87 per cent. respectively. It would, therefore, be unwise to accept the performance of the South Down at Cowra and Bathurst farms during 1922 as normal. The following table shows the figures from the two farms for the year under review :—

Cross.	Ewes mated.	Net return.
Cowra—		£ s. d.
South Down	98	14 3 4
Dorset Horn	98	111 17 4
Ryeland	98	96 0 8
Bathurst—		
South Down	49	55 19 2
Dorset Horn	99	93 5 1½
Ryeland	50	41 2 7½

The combined results of the two farms produce the following table :—

Cross.	Ewes mated.	Net return.	Average return per ewe mated.
		£ s. d.	£ s. d.
South Down	147	67 2 6	0 9 1½
Dorset Horn	197	205 2 5½	1 0 9½
Ryeland	148	137 3 3½	0 18 6½

The point must be stressed that the table shows the return obtained per ewe mated, and the figures demonstrate the profitable nature of fat lamb-raising to the mixed farmer, especially when one takes into consideration the additional return of the wool clip from the ewe flock which, under present ruling rates, should average about 7s. 6d. per head.

An interesting feature of the experiment is the result obtained from the Ryeland cross. This breed was imported into New South Wales by the Department of Agriculture in 1920, and although not yet in sufficient numbers to permit of their extensive use, they give every promise, on the results so far obtained, of being a useful factor in the fat-lamb trade. Further experiments with the breed are being conducted.

Crop Rotation on the Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Senior Agricultural Instructor.

In any district where intense culture is practised crop rotation is a very important part of the farm routine.

Dairying under irrigation conditions calls for the regular supply of fodder, which should furnish as near as possible a balanced ration. Most dairymen, if not all, are called upon to supplement the natural or artificial pastures by growing fodder crops, which may either be grazed or cut and fed green, or consumed as silage or hay.

The fodders thus required should be supplied by crops grown in a regular way—not haphazard, as is done by many farmers at the present time. If a farmer were to map out in some set manner a regular sequence of crops over that portion of his land which he intends to farm a plentiful supply of fodder would always be on hand, and, at the same time, the soil would actually be made to benefit.

Most crops, with the exception, chiefly, of lucerne and of the pasture grasses and clovers, occupy the land for only a few months of the year, so that by adopting a suitable rotation the work of the farm can be more evenly distributed over the year, and a regular supply of feed ensured.

In normal seasons a plentiful supply of grasses and herbage is usually available during the late winter and early spring, but even if the farmer has grown fodder it can be easily conserved.

What should be a suitable rotation for the irrigation areas should be based on the principle that the chief crops would be maize and sorghum (either alone or with legumes), and cereals associated with legumes. The latter mixture would either be cut and fed to stock or conserved, the subsequent growth being grazed off, or the crop could be used as a grazing proposition throughout. It would thus be necessary for the farmer to divide his cultivation land into three plots, and to sow as follows:—

Plot I.

Autumn, 1923.—Sow green fodders—oats, wheat or barley, with vetches, Bokhara clover, or a few pounds of lucerne. This plot could be grazed during winter, 1923, and until the end of winter, or early spring, 1924; the plot could be cut and fed in the winter and spring of 1923, and then used as a grazing proposition until the spring of 1924.

December, 1924.—Sow with sorghum and vetches, and cut in the autumn and winter of 1925.

September, 1925.—Sow maize with cowpeas; available in December, 1925.

Autumn, 1926.—Start with fodders again as in 1923.

PLOT II.

December, 1923.—Sow sorghum and vetches; available in the winter of 1924.

September, 1924.—Sow maize and cowpeas; available in December, 1924.

Autumn, 1925.—Sow green fodders, oats, &c., as in Plot I; available until the spring of 1926.

December, 1926.—Start rotation again with sorghums and vetches.

PLOT III.

September, 1923.—Sow maize and cowpeas; available in December, 1923.

Autumn, 1924.—Sow green fodders, oats, &c., as in Plot I; available until the spring of 1925.

December, 1925.—Sow sorghum and vetches; available in the winter of 1926.

September, 1926.—Start rotation again with maize and cowpeas.

Examination of the above rotation will show that while the oats and legume plots provide grazing, more especially in the second season's growth, one of these plots is also available each winter and spring with its first growth for cutting or grazing. A plot of sorghum is available each autumn or winter, while the maize has matured for summer feeding.

If the crops were cut and made into silage, a short fallow of from six weeks to two months could always be practised between the different sowings.

WHAT IS PROSPERITY.

WHAT is prosperity?

That is not prosperity which does not include the well-being of all workers.

That is not prosperity which does not give the labourer his full wage, nor the employer his full share.

That is not prosperity which fails equitably to compensate the tiller of the soil.

That is not prosperity which rewards speculation rather than production.

That is not prosperity which denies the incentive of just reward to each contributor in the degree of his contribution.

That is not prosperity which forgets the educational and cultural needs of all the people.

National prosperity can result only from the intelligent distribution of the nation's work, and the equitable distribution of the work's rewards. These rewards must go in due proportion to labour, to capital, to talent, to initiative. —J. H. PUELICHER, in *The Banker-Farmer*.

Farmers' Experiment Plots.

WINTER GREEN FODDER EXPERIMENTS, 1922.

Western District.

H. BARTLETT, Senior Agricultural Instructor.

WINTER fodder crops are not as yet extensively grown in the western district, but the attention of the western wheat farmer is being drawn to the necessity of producing them. Practically every holding carries a number of sheep, and to the "small" man, whose area is from 500 to 1,000 acres, the value of a green, nutritious fodder crop upon which to graze lambing ewes is inestimable.

Of course, seasons will occur when the growth of the natural herbage and grasses is sufficient for winter requirements, and at such a time, provided suitable crops such as barley or oats are grown, a great opportunity is presented of conserving the fodder crop as silage or hay.

Owing to the increase in fungus disease of late years, particularly foot-rot, take-all, and flag-smut, the introduction of a system of rotation of crops is most advisable, and if the rotation crop is either grazed or cut and a second growth allowed to take place prior to ploughing for fallowing, humus is added to the soil. The value of a fodder crop cannot be quoted in terms of cash, as the returns are all indirect, but experience teaches that fodder crops strengthen the stability of the farm, and assist in producing uniform stock and crop returns.

With the object of encouraging mixed farming and the growing of fodder crops, small areas of fodder crops have been sown by the Department of Agriculture in several parts of the western district during the past few years. The area partakes more of the nature of small demonstration areas than of experiment plots, and the farmers have been allowed to use the crops to the best advantage, some grazing the areas with lambing ewes, others with horses and cows, while a few have turned the crops into silage, which at the present moment is saving them the expense of leasing high-priced agistment country.

The cost of growing fodder crops is only a small item, as the seed-bed is quickly prepared, and the seed may be produced on the farm. As the farmer is busy on his fallows from January till April, the time he can spare for sowing fodder crops is limited, so he must depend upon the disc or spring-tooth cultivator to do the work. If the wheat stubble is burnt and the paddock cultivated directly after the first useful rains, a suitable seed-bed should result. Sowing should take place about the end of February or the beginning of March, and it is wise to wait until the seed-bed is sufficiently

moist to ensure germination. The greatest use will be made of the fodder by grazing often and lightly. and it is a mistake to allow the crop to be in ear before grazing, owing to the waste occasioned by the tramping of stock.

The crops most in favour at the present time are Skinless barley, Cape barley, and Sunrise oats. Skinless barley will give the greater amount of fodder for early grazing, though the ultimate amount of fodder produced appears to be about equal. Oats will probably gain in favour, as they are practically immune to take-all. Success with leguminous crops has not yet been attained, and although they possess advantages over straw crops as soil renovators, they do not appeal to the practical western farmer. Rape is a useful crop for grazing purposes, but any excess of rape fodder in a good season is wasted, as it is not suitable for silage.

Growth of Crops

During the autumn of 1922 the fodder crops experienced rather a trying time. Mice were responsible for destroying a percentage of seed, especially in the lighter types of soil, and the dry conditions which continued till the end of April delayed germination, which in many cases was thin. The growth throughout, though not bulky, was satisfactory in view of the light rainfall, and was particularly valuable owing to the scarcity of natural pastures.

The farmers who co-operated with the Department in conducting winter green fodder experiments during 1922 were:—

J. Paislow, Collie Road, Gilgandra.
W. W. Watson, "Woodbine" Tichborne.
E. J. Allen, Gregra.
S. Reilley jun, Eurimbla, via Cumnock.
M. F. Dalton, Duntryleague, Orange.
A. H Newton, Armatree.
Hughes Bros., Pullabooka.
E. A. Draper, Alectown West

Excepting at Gregra and Pullabooka, the germination and growth of Grey field peas was very poor. Skinless barley gave satisfactory results in all centres, while Cape barley, though giving less bulk, produced a fodder more relished by stock. Oats, where tried, had much to commend it, and more numerous sowings are to be made.

RAINFALL.

1922.	Gilgandra.	Tichborne	Orange	Armatree	Pullabooka.	Gregra.
	Points.	Points.	Points.	Points.	Points.	Points.
March	Nil	Nil	2	Nil	Nil	37
April .	73	142	174	133	104	133
May	27	96	149	299	88	84
June	124	108	264	68	61	142
July	169	211	704	30	182	320
August ..	33	111	146	58	147	86
	426	728	1,439	588	582	802

Details of Plots.

Gilgandra.—Soil, red to grey loam, area 10 acres. Previous crop, oats 1921; disc cultivated 5th January; disc cultivated 1st March; sown 10th March. (1) Grey field peas, ½ acre, sown in alternate drills at the rate of 40 lb. per acre. (2) Cape barley, 4½ acres, 40 lb. per acre. (3) Skinless barley, 5 acres, 45 lb. per acre. Superphosphate at the rate of 56 lb. per acre. The germination of the peas was fair and of the barleys good.

The stocking was as follows:—1st August, 100 ewes with lambs, for 10 days; 20th August, 92 sheep, 4 days; 8th September, 58 sheep, 6 days; 29th September, 58 sheep, 13 days; 11th October, 119 sheep, 7 days.

Tichborne.—Soil, light red loam; area, 10 acres; previous crop, oats, 1921, for hay. Mouldboard ploughed, 26th December, 1921; disc cultivated, 10th March; sown, 14th March; (1) Grey field peas, ½ acre, every alternate drill sown at the rate of 40 lb. per acre; (2) Skinless barley, 5 acres, seed 50 lb. per acre; (3) Cape barley, 4½ acres, seed 50 lb. per acre. Superphosphate at the rate of 56 lb. per acre. Germination of peas, fair; of barleys, good.

The stocking was 3 cows for 86 days; 14 horses for 10 days. A 12-inch growth was ploughed under on 10th September.

Gregra.—Soil, rather heavy red loam; area, 20 acres; previous crop, wheat, 1921. Mouldboard ploughed, 8th February; harrowed in March; sown on 6th April; harrowed 7th April. (1) Grey field peas, 2 acres, sown alternate drills at the rate of 40 lb. per acre; (2) Skinless barley, 6 acres, 45 lb seed per acre; (3) Cape barley, 6 acres, 45 lb. seed per acre; (4) Sunrise oats, 6 acres, 45 lb. seed per acre. Superphosphate was applied at the rate of 56 lb. per acre. The germination was good throughout all plots.

The paddock was grazed at different periods with 10 horses, 50 sheep, and 13 cattle.

Eurimbla.—Soil, rather heavy red loam; area, 11½ acres; previous crop, oats, 1921. Mouldboard ploughed, 6th April; harrowed, 20th April; sown, 25th April. (1) Cape barley, 6 acres, 50 lb. per acre; (2) Skinless barley, 5½ acres, 50 lb., and Grey field peas 30 lb. per acre. Superphosphate was applied at the rate of 56 lb. per acre. The germination of the peas was fair, of the Skinless barley good, and of the Cape barley good.

The stocking consisted of 15 horses for 8 weeks, and 250 sheep for 14 days.

Orange.—Soil, red to grey loam; area, 5½ acres; previous crop, wheat, 1921, cut for hay. Ploughed 4th April, harrowed twice, sown on 12th April. (1) Grey field peas, ½ acre, sown every alternate drill, at the rate of 50 lb. per acre; (2) Cape barley, at 50 lb. per acre; (3) Skinless barley, 50 lb per acre. Superphosphate was applied at the rate of 56 lb. per acre. The germination of the peas was very poor, and of the barleys good.

The stocking was 3 cows for 7 days, 5 horses for 1 day, 100 sheep for 21 days.

Armatree.—Soil, light red loam; area 12 acres; previous crop, wheat, 1921. Mouldboard ploughed in February, 1922; springtooth cultivated 10th March; sown 14th March. (1) Grey field peas sown every alternate drill at the rate of 37 lb. per acre. (2) Rape, 7 lb. per acre. (3) Rape 7 lb. and Skinless barley 17 lb. per acre. (4) Skinless barley, 60 lb. per acre. (5) Cape barley, 50 lb. per acre. (6) Sunrise oats, 50 lb per acre. Superphosphate was applied at the rate of 56 lb. per acre. The germination of the peas was very poor, of the rape medium, of the barleys also medium, and of the oats poor.

Owing to the block not being fenced full grazing use could not be made of the fodders, the stock having to be shepherded.

Pullabooka.—Soil, red loam; area 12 acres; previous crop, wheat, 1921. Disc ploughed 15th February; disc cultivated 7th March; sown 8th March. (1) Grey field peas sown every alternate drill at the rate of 40 lb. per acre. (2) Skinless barley, 45 lb. per acre. (3) Cape barley, 40 lb per acre. Superphosphate was applied at the rate of 56 lb. per acre. The germination of the peas was fair, of the Cape barley medium, and of the Skinless barley good.

The stocking was as follows:—From 15th August to 26th August 420 ewes, 411 lambs (2 months old), 69 hoggetts. Stocking took place just after marking, the ewes at the time being rather weak. The sheep showed a very marked improvement in condition.

Alectown West.—Soil, red loam; previous crop, oats, 1921. Mouldboard ploughed 20th December, harrowed in January, springtooth cultivated on 1st March, sown 10th March. (1) Grey field peas were sown every alternate drill at the rate of 40 lb. per acre. (2) Skinless barley, 45 lb. per acre. (3) Cape barley, 45 lb. per acre. Superphosphate was applied at the rate of 30 lb per acre The germination of the peas was fair, and of the barleys very good.

The stocking was:—11th August, 14 horses for 21 days, 20th September, 14 horses for 7 days.

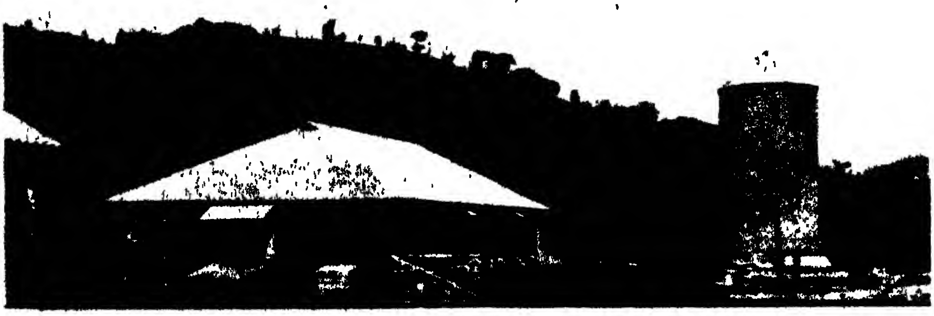
Bigger Dairy Profits by Feeding the Right Cows.

The records of many thousands of tested cows have been gone over in the last few years by the United States Department of Agriculture. It was found that from the lowest-producing group of cows to the highest-producing group, every jump of 50 lb. in annual butter-fat production was accompanied by an increase of about 16 dollars in income over cost of feed. The average production of the 21,231 cows whose twelve-month records were studied was 6,077 lb. of milk and 248 lb. of butter-fat, or about 50 per cent. more than the average of all the dairy cows in the country. The records show that selection of animals and better methods of feeding raise the average production rapidly during the first year or two that the cow-testing association is in operation, though the figures for subsequent years show smaller gains.

An Effort to Reduce Lamb Mortality.

LOCAL statistics show that of the number of lambs said to have been dropped during the seasons 1915 to 1921 slightly over one-half were lost. Of the adverse influences responsible for this tremendous percentage of mortality food shortage and exposure were probably the chief. In the accompanying illustration are shown the means adopted by Mr. F. F. Albertson, of Dungowan, to guard against losses under these two headings.

Lambing in the district takes place in the winter. For some years the 28 acres of lucerne on Mr. Albertson's farm (subdivided into three paddocks, and with a grazing paddock of 20 acres handy to all three) proved all sufficient for the maintenance of the flock, an occasional dry winter finding ample reserves in the form of lucerne hay. When the seasons became on the average somewhat drier, however, the sources of feed became less



Silo and Shelter Shed for Ewes at Dungowan.

adequate, while the losses due to the ewes being as a consequence in low condition were very seriously augmented by the depredations of foxes. Combat of the latter proved difficult, and the expenditure during the winter of 1919 of £200 on trucked fodder to keep the large stock alive culminated in a serious review of the whole situation. It was as a result of a consideration of the measures promising greater security and economy that it was ultimately decided to build a silo in which to conserve the maize it was usually possible to produce on the farm and a shelter-shed for the ewes.

The silo was built during the winter of 1919 at a cost of £180; it is constructed of concrete blocks and has a capacity of 100 tons. Up to the time of Mr. Alderson's communication there had been no occasion to feed the sheep on silage, but it had already proved useful, sixty-six head of large stock being kept alive on a bare ration of maize silage during the winter of 1921.

The shelter-shed measures 80 by 40 by 10 feet, houses comfortably 300 ewes, and cost £700. It has ample provision for ventilation, the whole of the brickwork being built on arches which are below the grating floor, and the walls fitted with shuttered windows and air vents, and the roof with movable skylights. In one corner is a comfortable room (floored and

ceilinged and with fireplace) for a watchman, so that the sheep may receive every attention during the night. Immediately on completion the building was put into use, when 256 ewes were housed every night for five weeks, with an 85 per cent. drop of lambs and the loss of only one ewe. This percentage drop would have been higher had not the previous good season resulted in the lambs being abnormally large at birth, and therefore troublesome lambing. Compared with the returns obtained during the years before the fold was in use the figures were at a marked advantage, foxes accounting in previous years for as many as eighty-seven of the lambs dropped by 317 ewes, to say nothing of the losses of ewes themselves and lambs at birth as a consequence of the ill-effects suffered by the ewes through exposure.

A Poison Bait for the Common Black Ant.

A POISON bait which was reputed to have been used with success to control the Argentine ant in America has lately been employed in experiments carried out by the Department with the domestic ant (*Iridomyrmex rufoniger*), which has been particularly prevalent this summer along the coast and suburbs.

The formula of the bait was as follows:—Sugar, 9 lb.; water, 9 pints; tartaric acid (crystallised), 6 grams; benzoate of soda, 8·4 grams; sodium arsenite (C.P.), 15 grams, or commercial sodium arsenite (containing 60 per cent. arsenic), 25 grams; honey, 1¼ lb. All the ingredients except the sodium arsenite and the honey were first boiled together slowly for thirty minutes and allowed to cool. The sodium arsenite was then dissolved in half a pint of hot water; this was also allowed to cool, and subsequently added to the cool sugar syrup, and the whole stirred well. Finally the honey was added, and the bait mixed thoroughly.

Preliminary tests of this bait carried out in houses and gardens where the ants had been a pest for some months proved very successful. The bait was first laid on 12th December, 1922, being placed in twelve covered tins around one house, and in ten similar tins around another house. Within twenty-four hours the bait had drawn away the ants from the houses and food stores, and they have not since returned. The bait poisoned large numbers of the pest, and being a slow poison, was probably conveyed to the nests by the workers and fed to the larvæ and queens.

On 2nd January the writer inspected the houses, and found that the active lines of the ants outside the buildings and on the walls had disappeared, except at the corner of one of the houses, where a single line of ants was observed. The obviously diminished numbers seemed to prove the destructive capacity of the bait, for no rain had fallen, the weather remaining persistently hot and dry during the whole period of the test.

The bait was set out in small tins with the lids fitted on to keep out dust and rain, but the sides of the tins bent inwards so as to form openings that allowed the ants easy access. About 4 oz. of the bait to each tin was found sufficient, and this should last for about a month without fermenting. Sufficient rag or sponge to absorb practically all the bait was put into the tin, so that the ants could obtain a foothold and feed on the bait in large numbers.

The formula given above should be carefully followed. It is easy to make a bait which would poison the ants more quickly, but the object is to provide a slow poison, which permits the ants to return again and again before being killed, carrying off the bait to feed and poison the larvæ and queens in the nests.—W. B. GURNEY, Assistant Entomologist.

Poisoning of Sheep by "Narrawa Burr."

(*Solanum cinereum.*)

SYDNEY DODD, D V.Sc. F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, University of Sydney.*

EARLY in the year 1922, Mr. Stock Inspector White, of Merriwa, forwarded a dried specimen of a plant locally known as "Wild Tomato" to the Chief Inspector of Stock, Sydney, for the purpose of ascertaining what was known concerning it. The plant was suspected by a stockowner in the above district of causing, on more than one occasion, the death of a number of his sheep. A specimen had previously been sent to the Government Botanist, Mr. J. H. Maiden, who identified it as *Solanum cinereum* and stated that it was a native plant, its popular name being "Narrawa burr." It had spread a good deal during the past few years and to such an extent that several shires had proclaimed it a noxious weed. He had no knowledge of its being poisonous to stock, but suggested that as it belonged to the Solanaceæ, which includes some undoubtedly poisonous species, veterinary opinion should be sought on the subject.

As a result of correspondence after the experiments to be described had been completed, Mr. White stated that odd plants were to be found in the Merriwa district, but it is only on certain holdings that it is growing in any quantity and here it is becoming somewhat of a pest. Prior to the above incident, he had never heard of the plant being suspected of poisoning stock. Some sheep had at times died mysteriously, but death had usually been attributed to other plants, *e.g.*, *Euphorbia drummondii*. Sheep do not feed willingly on the plant, rarely touching it when other food is available; but they will eat it when other food is scarce or dry. On the particular station whence arose the inquiry, there was plenty of dry grass in the paddock where the deaths had occurred, together with a fair amount of *Solanum cinereum*. Only some of the sheep had been eating the fruits of the latter and nibbling at a few of the leaves. Numbers of sheep did not touch either fruits or leaves. The former are generally eaten ripe.

In the case causing the inquiry, there were 1,100 sheep in a particular paddock, and of these forty-five died. It was not known what time had elapsed between the first eating of the berries and the commencement of the mortality, but some sheep had been observed eating them two or three weeks before any dead sheep were found. Thirty sheep, however, died, apparently suddenly and quietly, within a few days of each other, from what appeared to the owner to be the result of eating the fruits of the plant later on identified as *Solanum cinereum*. The reasons for this conclusion

* Paper read before the Royal Society of New South Wales, September, 1922.

were that the fruits had been eaten off plants growing in the paddock, and also, when being yarded, the sheep were again observed to do the same thing. The same class of sheep in an adjoining paddock had not touched either leaves or fruits of the plant, and no deaths had occurred. The owner also considered that this occurrence presented the same features as were noticed in connection with some previous losses, which he also thought to be due to the same plant.

In order to ascertain experimentally whether *Solanum cinereum* was toxic or not, Mr. White was requested to forward a consignment for that purpose. About 10 lb. of the dried mature plant were received, each plant carrying many fruits, but the latter were also quite ripe and dried up Although these had a far different appearance to the ripe juicy fruits that the sheep had been feeding on, it was resolved to carry out some feeding experiments with them.

The botanical description of *Solanum cinereum* is given in Bentham's "Flora Australiensis," vol. iv, p 460

Feeding Experiments with *S. cinereum*

Sheep No. 100, *aged* 2 *years.*—Noon, 15th May, 1922. Administered by mouth 8 oz. of solanum berries (dried) mashed up with water to form a pulp. The animal would not swallow the mixture voluntarily, but was made to take the lot by placing a little at a time in the mouth and waiting until it had been swallowed.

At 2 p.m. when the animal was inspected, it was apparently well. Having been called away for the afternoon, I left instructions that another dose might be given at 4 p.m. if necessary. The animal, however, died at 3.30 p.m., during my absence, three and a half hours after the fruits were administered.

Post-mortem examination was made next morning. There was some evidence of salivation and diarrhœa. The liver, kidneys, abomasum and intestines were deeply congested. A number of sub-endocardial hæmorrhages were present. No other lesions were seen.

Owing to the rather unsatisfactory conclusion of this experiment, it was resolved to repeat it, and in order to avoid any suggestion that death may have been hastened by some of the liquid going "the wrong way," it was decided to give the berries whole and free from water.

Sheep No. 101, *aged* 2 *years.*—10 a.m., 16th May, 1922. Fed with 4 oz. whole dry berries (ninety-six in number) of *S. cinereum*. The fruits were simply placed in the mouth of the animal, a few at a time, the mouth being lightly held until the animal had swallowed them. The result was negative; not the slightest sign of inconvenience being seen.

4 p.m., 16th May, 1922. Administered the same weight of dry, intact fruits (ninety-three in number) in the same manner as at 10 a.m., making a total weight of 8 oz. within six hours. The result was again negative.

In view of the above negative results and the positive result obtained with Sheep No. 100, although in one case the whole amount of fruits was given at one time, whilst in the other it was given in two lots with an interval of six hours, it was for reasons to be discussed later, decided to give sheep No. 101 the total amount of 8 oz. of berries emulsified in water. The following are the details:—

Noon, 22nd May, 1922. Sheep No. 101 was given, by the mouth, 8 oz. of *S. cinereum* fruits (266 in number) mashed up with water. The emulsion forming a thick pulp.

2 p.m. The animal, which normally was very wild, had now become very quiet and easy to handle without assistance. Respirations were stertorous and rather heaving. Temperature 103 degrees Fah. Slight salivation, mucous membranes intensely congested. Fæces pultaceous.

4 p.m. Temperature 104 degrees Fah. Pulse 102 and bounding. Respirations 80 and heaving. Profuse salivation. Moderate dilatation of the pupils, mucous membranes cyanotic. A massive and pultaceous motion. Animal able to stand but very weak and easily pushed over. Perspiring freely. Some eructations of gas from the mouth.

7 p.m. Animal dead. There had been some struggling at various intervals and a profuse, fœtid diarrhœa prior to death. Death occurred seven hours after the administration of the berries.

Post-mortem examination was made next morning. The sub-cutaneous vessels and peripheral lymphatic glands were congested. About 100 c.c.'s. of blood stained, turbid liquid in the peritoneal cavity. The spleen showed a number of subcapsular hæmorrhages. The liver was moderately and the kidneys intensely congested. The latter having a number of small hæmorrhages in the cortex. The mucous membrane of the abomasum and intestines was also greatly congested, with a considerable amount of mucus on the surface. The lungs were normal. Pericardium distended with a turbid, blood-stained liquid.

Remarks.

On account of the difficulty of administering the dried, intact fruits, they were given in the case of the second animal in two lots of 4 oz. each, with an interval of about six hours. The result as noted, was negative.

Six days later, the animal was given the same total amount of fruits, but this time they were emulsified in water, with the result that death took place in seven hours. The question arises, why should the berries when eaten in the dry state be apparently innocuous, whilst the same amount when mashed up with water caused death in such a short period? The probable explanation is that when the fruits were given whole and dry, they were swallowed in the ordinary way, without preliminary mastication and passed into the rumen. Here they would become mixed with the other contents of that portion of the stomach. When rumination took place, the amounts of fruits masticated, re-swallowed and passed on to the true digestive stomach, would not only be non-lethal, but insufficient to cause any visible symptoms of poisoning. On the other hand, when the fruits were

mashed up in water, only a little of the mash was found in the rumen post-mortem. Furthermore, all the liquid portion of the emulsion containing the soluble alkaloids, would pass direct into the abomasum, &c.; consequently, as a lethal dose had reached that part of the alimentary tract where absorption would take place, death occurred rapidly.

Chemical analysis of the fruits is now being conducted by the Department of Agriculture. The result of this has not yet been made known. The clinical evidence however, appears to indicate that the plant belongs to the Solanine group of the Solanaceæ, rather than the Atropine or Nicotine groups, and that the glucosidal alkaloid solanin is the principal active agent.

Conclusions.

The fruits of *Solanum cinereum* contain a poisonous principle, probably solanin. If the fruits are eaten fresh and in sufficient quantity (at least 8 oz., and this is not a large amount to ingest at one time), the soluble alkaloid passes directly into the abomasum and will cause death in a few hours. The chief symptoms of poisoning by this plant are. salivation, perspiration, intense congestion of the visible mucous membranes, disordered cardiac and respiratory actions and diarrhœa. In small amounts, however, the fruits do not apparently occasion any pronounced illness. The symptoms shown by the experimental animals and the post-mortem findings, indicate that the principal active toxic agent is solanin. Dried fruits, even in poisonous amounts do not produce any ill effects unless a relatively large quantity be consumed.

Good Grazing for Dairy Cows.

Messrs. Connell and Co., Noondah, Tumblong, reported on 6th March concerning their experience with fodder crops this season as follows:—

" English ryegrass was sown on the river flat in May at the rate 15 lb. per acre. With good rains in May and June it struck well and cows were on it in July, August, September, October and November. It had a heavy growth and stood stocking well and is now short but green. New Zealand red clover was sown at the rate of 5 lb. per acre. This also made very rapid growth during the spring months and seeded heavily. . . .

" Sudan grass was sown on 4th October at the rate of 13 lb. per acre on flooded flats ploughed in August. This cow fodder made rapid growth and in eight weeks after sowing was cut. Five weeks after cutting the cows were turned in. The crop is standing out very well, still stooling strongly when eaten down. The average height is 5 feet 6 inches; in parts up to 7 feet 9 inches. The Murrumbidgee flats seem to be especially adaptable to Sudan grass, and for grazing purposes would be hard to beat. We have about four beasts to the acre on it, and they make no impression at all on the crop.

"It might be added that our cows are milking extremely well on this fodder, and although heavy in calf have kept the quantity of butter up for the past three months without a shrinkage of supply."

Dairying Under North Coast Conditions.

Wanted—Better Breeding and Rearing Methods.

A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

Of all animals the dairy cow is the most economical producer of human food. No other animal can utilise large quantities of feed to such advantage, returning to her owner a valuable and necessary product, and, if properly handled, at the same time building up (not depleting) the fertility and value of the farm. It is this bovine capacity for economical production of an essential commodity that enables dairying to give a higher return per acre than perhaps any other primary industry, and hence to occupy the most valuable of all land.

These facts—so elementary and well known—suggest at once the measure in which the prosperity of the industry depends upon the productivity of the animals employed in it. If herds of the present average standard are capable of maintaining their owners on the high-priced land of the North Coast, how much more profitable would dairying be were the cattle yielding 10 or 20 lb. more butter per annum than at present! Yet there is nothing impossible about such a proposition. A few months ago Mr. E. H. Filmer, of Bimbaya, furnished the information that in the season 1919–20 the average yield of his herd was 186 lb. butter per cow; in 1920–21 the average of seventy-two cows was 204 lb., and in 1921–22 the average of seventy-seven cows was 217 lb. per cow. An average improvement of 31 lb. per head was thus shown in the third season—an improvement which he said had been largely effected by the culling of poor producers, and in the third season twenty-five out of the whole herd of eighty-four were heifers on first or second calves. A very simple calculation will show whether or not that improvement justified the expense of herd-testing, and the time and thought involved in the culling of the herd.

Nor does all this apply only to pure-bred stock. Owners of such herds know that the presence of poor animals on their farms is a serious detriment to the reputation of their herds, but they also know that poor producers are not worth feeding. Among herds of that kind averages of over 300 lb. and 350 lb. of butter per head are not rare, and to such men it is hardly necessary to talk of improvement.

It is with the owners of the vast number of herds that produce only an average of perhaps 200 lb. of butter per head that we would talk of herd improvement. To them it is a matter of real and monetary importance. Many of them are making only a bare living—yet the possibilities of a substantial improvement in their position are easily within their reach.

With a small outlay upon a bull from a family known to produce well—with a determination to rid themselves of poor unprofitable beasts—with a little more care in the choice of the calves they keep—with a rigid rejection of every calf that does not promise well—with the addition, too, of fodders grown on the lines suggested in our article of two months ago—in fact, with a little more appreciation for the possibilities of their own business, and some sense of the side upon which their bread is buttered, it is possible for dairy-farmers to turn a struggle for existence into a life of some prosperity and of pleasurable interest. Setting aside then any thought that herd-improvement depends on the outlay of fresh capital upon a better herd—a thing beyond the resources of nearly everyone in the business—we turn to the slower but eventually quite as satisfactory method of breeding and rearing better stock on the farm, and of culling unpromising calves before any appreciable amount of time or money has been spent upon them.

The Bull as a Factor.

A word first as to the potency of the bull in the improvement of the herd. Hardly anyone entertains any doubt about it, but the extent of the effect of the bull upon the herd might be illustrated from the records of the pure bred Jersey herd kept at New York Agricultural Station, U.S.A. Recently published documents show that the daughters of the bull used from 1903 to 1907, inclusive, averaged 496 lb. of butter-fat per year as against an average of 427 lb. for their mothers—a net gain of 69 lb. per year in favour of this sire. The daughters of the bull used from 1915 to 1917 averaged only 272 lb. of butter-fat per year, while their mothers as two-year-olds had averaged 362 lb.—a net loss against that sire of 89 lb. per year. More conclusive evidence of the influence a bull may have upon a herd could not be desired.

It is not enough that the herd bull should be pure-bred. There are such things as poor pure-breds. Nor is it enough that he should show the points of his breed. He must be of a productive family, his dam, his sisters, and his daughters, if any, having proved themselves to be good performers.

Some herd owners in the United States hold that the selection of the bull according to his capacity to endow his daughters with the power of high milk production is the only reliable method. This, of course, involves keeping the bull for several years, instead of for two or three—a thing few farmers can do, as it means in practice keeping more than one bull on the farm. Efforts should be made, however, to trade bulls in such a way that their whereabouts may be known. The fact is recorded about one of the American official herds, that a certain bull which was disposed of early in his career, was found afterwards to have sired some of the best stock ever in the herd. Every effort was made to trace him with a view to making further use of him, but neither he nor his progeny could be heard of. How many farmers have had similar experiences after their heifers have begun to come to profit? No doubt many bulls are well got rid of, but others would be worth a good deal to get back. The heifers are the best indication of a

bull's value, but no young sire should be introduced into the herd whose dam, grand-dam, and, if available, his sisters, have not proved their capacity for production.

The bull, therefore, should be of a vigorous, masculine type, capable of transmitting his characteristics to his offspring. Constitution should be indicated by a capacious chest, much width through the region of the heart, a bright full eye, round barrel, and well sprung ribs. The skin should be soft and pliable, the neck should carry a good deal of crest, and there should be nothing coarse or flat over the shoulders. The carriage should be active and the manner alert, though the temper must be equable. The placing of the teats in a calf generally follows closely that of the rudimentary teats in the bull, hence a sire should not be purchased in which they are not properly developed and well placed. If they are bunched together the animal is certainly not a desirable one. Lack of constitution is indicated by a dull sunken eye, a long thin neck, flat ribs, long legs, cramped lung and heart space, harsh skin, and staring coat.

The above are the characters that should receive consideration in the choice of a bull of any breed.

The Desirable Dam.

Similarly the cow to purchase and to breed from—quite apart from the qualities of her breed—should show femininity and constitution. A distinctly feminine appearance is an indication of activity of the sexual organs. Constitution is denoted by a broad chest, giving ample lung capacity, and a large girth, affording plenty of room for the heart. The barrel should be both deep and long, for there is then plenty of room for the digescion of large quantities of feed. The eye must again be full and prominent, the carriage active, the skin loose and soft, the horns and hoofs fine. In form a dairy cow should be wedge-shaped, light in front and heavier behind, and the pelvis broad. The best milkers have invariably a well shaped udder, and large and tortuous milk veins that extend all over the udder and away from it. Good milkers are generally spare in flesh. Cows that do not produce, say, 160 lb. of butter-fat in a lactation period of 273 days should not be mated, but should be dried off, fattened and sold.

None of the above must be regarded individually as infallible signs of heavy production. It is the combination of all that the experienced herdsman looks for.

Factors to Consider in Mating.

The possession of good stock in the herd is not everything in the breeding of profitable youngsters. Judgment is also necessary in mating sire and dam. In some measure the deficiencies of one may be rectified by the qualities of the other, but this is only true in a measure and only of certain characters. There is no assurance, for instance, that lack of constitution in one animal is likely to be compensated for by the other. The chances of the progeny of such a union proving a "scrub" are sufficient to justify the owner in rejecting the defective animal altogether.

Temperamental differences require to be taken into account; two highly nervous animals are not likely to mate to the advantage of the owner. Relationships must also be watched; if blood connection exists, it may be inadvisable to mate the animals. It is quite true that some famous herd masters have done daring things in the way of breeding, but it is better for ordinary mortals to tread safer ground.

The feeding is a factor of consequence in mating cattle. Insufficient nutrition and excessive nutrition are both adverse to healthy and vigorous action of the genitive organs. Cows poorly wintered, for instance, will not mate until some time after the pastures have improved. An ample supply of good nutritious food, well balanced as to its component parts, is what the herdsman should seek to ensure.

The Cow in Calf.

The raising of the young stock may be said to be the fundamental principle of successful dairying. It begins, not with the birth of the calf, but quite soon after the cow is found to be in calf. Whatever is gained by the culling of the poor animals in the herd and the purchase of a bull of good family, can only be maintained by a suitable and abundant supply of food. There are herd owners who contend that the food artificially supplied has probably done more than anything else for the improvement of live stock, and doubtless there is much in their contention. Certain it is that any reasonable outlay of time and money on careful feeding of the pregnant cow is amply repaid.

To stimulate the milk flow and to maintain conditions favourable to conception in the first instance, the following mixture has been found useful at this farm:—

Maize (cracked)	30 lb.
Bran	20 lb.
Oats (crushed)	10 lb.
Linseed meal	5 lb.
	65 lb.

Albuminoid ratio, 1 to 5·20.

In addition to ordinary pasture 1 lb. of the above mixture is fed daily to each 3½ lb. to 4 lb. of milk yielded. After the cow has been served by the bull, the feed is increased to 1 lb. of the grain mixture for each 2½ lb. of milk, in order that both the milk flow and the development of the calf may be maintained. In the case of Hope of Wollongbar, who lately completed a record-breaking performance, the ration was fed at the rate of 1 lb. to each 4½ lb. of milk produced for the first five months, and 1 lb. to 2½ lb. of milk produced in the latter months

The drain upon the physique of a cow that is yielding a good flow of milk and at the same time nurturing a healthy calf is a very considerable one, and the period of rest towards the end of gestation should therefore be not less than five or six weeks.

Good feeding is still necessary, however, if the calf is to be given every chance of developing well. On the average dairy farm the ordinary pasture of the dry paddock is considered sufficient, and perhaps it might do at times when the pasture is particularly abundant and well balanced — grasses and clover or some other combination of fodder plants growing well together. But if the best of which she is capable is to be obtained from the pregnant cow, the dry paddock must be supplemented with a grain ration, and the one mentioned above has been found quite useful for the purpose. If the grain is grown on the farm, as suggested in a previous article, the expenditure is not very appreciable, while the advantage is great.

The Calving.

On a succulent pasture it should not be necessary to give laxatives as calving approaches, but if the grass is at all dry, it is advisable in the last week to stop feeding grain and to give about 5 lb. of dry bran daily. Drenching should be avoided, if at all possible, a moderately relaxed condition of the bowels being what is desirable.

Calving should take place in a small, clean, well-grassed paddock. The troubles of young calves can often be connected with calving occurring where there is a possibility of the presence of germs of previous disease. The attention given by the cow to the umbilical cord when she is licking the youngster over, is evidence in itself of the importance of that part as a possible source of trouble, and some men are so careful as to wash it with a very weak antiseptic solution. This should be unnecessary, however, if cleanliness is preserved in other respects.

At birth the bowels of the calf are packed with a heavy, tenacious substance, for the discharge of which nature has provided a laxative in the colostrum or first milk of the dam. The calf should be allowed to remain with the cow for two or three days, in order that the bowels may be thoroughly cleared out in a natural fashion, and be left in a condition in which they will perform their functions in a normal way. In that period, too, the calf learns to drink, and is subsequently handled with greater ease at the pail. The separation from the mother, however, is quite necessary as the calf grows, for calves reared on the mother have a very beefy tendency.

The First Feeding Period.

Removed from the cow to the stall or yard for very young stock, the calf should be fed not less than twice daily for the first month. For the first few days three feeds per day is in the calf's favour, even if it is a little extra trouble.

New, whole milk should be given for the first month. Many men stunt their calves and restrict development of the constitution by introducing skim milk too soon. No doubt whole milk costs a little more, but the outlay is small compared with the effect upon the subsequent health and value of the calf, and a shapely, promising youngster is well worth it. Beginning with, say, 1½ quarts three times daily or two quarts twice daily, the quantity may be increased slowly as the animal's capacity enlarges.

The Second Feeding Period.

When a month old the calf may be removed to the paddock in which those that are a little older are run. Skim milk may now be gradually introduced into the ration, and at the same time a grain ration supplied. This may consist of something in the nature of crushed oats and ground maize, with perhaps a little bran and linseed meal. It should be fed after the milk, and preferably in a bucket. Some place the dry ration in a long trough, but it cannot be rationed out to the individual animals under such circumstances as it can be in a separate vessel for each calf. No doubt work is involved, but the best of stock cannot be got without it. The grain ration has the advantage, if fed after the milk, of preventing the development of the habit of sucking one another, which is the cause of many cases of misshapen udders in mature animals. If the farmer is not disposed to feed grain, he should at least supply a little sweet hay or chaffed roughage to divert attention from the sucking.

Three Prime Essentials.

As to the feeding, there are certain things to which too much importance can hardly be attached. The first is the need for *scrupulous cleanliness with the feeding vessels*. The buckets should be scalded thoroughly every time they are used, and so also any feeding apparatus used. The second is *absolute regularity as to feeding time*, and the third *absolute uniformity as to temperature*. Neglect of these last two things has more to do with calves' troubles than many people have any idea of. Indeed, it is surprising how many farmers have never contemplated them as factors of any consequence in calf-rearing. Yet, both should be self-evident.

A healthy regularity is likely to be promoted by feeding at the same time every day, while varying temperatures are obviously detrimental to the delicate, tender organs of the alimentary tract. Attention to the last is most necessary where a number of calves have to be fed or where the weather is particularly cold. Many very successful rearers of calves insist on having boiling water available during the whole time the calves are feeding, so that a little can be added as required to keep the milk ration up to blood heat. It is not necessary to use a thermometer to test the temperature, for a skilful feeder can tell by dipping his finger in the milk, although it must be remembered that on a very cold or frosty morning the milk will feel warmer than it really is if the fingers are very cold.

As the calves grow they should be encouraged to eat as much roughage, such as hay or chaff, as possible. The effect is to develop the barrel and increase the capacity of the digestive organs for dealing with large quantities of food and turning it into milk. This development of the digestive organs can be begun with little difficulty while the animal is young, but it is practically impossible to modify the shape and conformation of a heifer that has been neglected up to the time she is, say, twelve months old.

Treated on the above lines, little trouble will be experienced in the way of "scours." Clean buckets, regular feeding, uniform temperature of the milk, and close observation of the droppings of each calf will prevent serious losses. When looseness of the bowels makes its appearance, we have found it good practice to give 1 oz. to 1½ oz. of castor oil to remove the disturbing element from the alimentary tract and to heal any irritation that may have been caused. The milk ration should be reduced to perhaps one-half for a day or two. Very few cases will refuse to yield to this treatment, but if it is not sufficient in twenty-four hours, a pint of flour gruel given in the milk is good. The gruel is prepared by scorching a quantity of white flour and adding hot water, allowing the mixture to boil for a moment. This treatment has never failed to effect an improvement in twenty-four hours. It is a mistake to give anything that will check looseness of the bowels until the organs are in a condition to receive it, or until they have been cleared of any irritating element. But generally speaking, prevention along the lines emphasised above is better than all treatment.

The Third Period.

The young stock should be divided into separate enclosures as to age. If possible there should be three enclosures, though of course this may depend in a measure on the size and the general conditions of the herd and farm. Calves of up to one month may be run together, then those of over one month and under four months (where skim milk is gradually introduced and a grain ration supplied), and finally those of four months and up to seven months or weaning time.

When the young stock are turned out after weaning they may still be supplied with a little feed, such, for instance, as a fews pounds of lucerne or oaten hay per day. Assistance is still needed in the building up of a good constitution and in the development of the capacity for heavy feeding, and the outlay is well repaid when the youngster presently takes her place in the herd.

It is hardly necessary to add that the same attention at all stages is necessary with the bull calf. He also has to be developed into an animal of vigour and constitution, and it is impossible to do this by any other way than liberal feeding. Grass is not sufficient if quality and profit are to be obtained to the maximum.

Again, the Starling Problem.

The most promising method of dealing with the starling is to observe the place where the birds rest at night and feed in the early morning. The settlers in a district should then co-operate to lay good feed for a week or more until the birds have become accustomed to the spot and are coming regularly for the food. Poisoned feed should then be spread. It will be found that enormous numbers can be killed in this way.

The method is better than the gun, of which the birds soon become very wary.—W. W. Froggatt, Government Entomologist.

Experiments with Arsenical Dipping Fluids.

[Concluded from page 200.]

LIONEL COHEN, F.C.S., Chemist, Tick Board of Control.

Ticks in Second Moult during Treatment.

It is noteworthy that all the surviving female ticks found on different classes of cattle, treated with varying strengths of medicament and at separate seasons of the year, were in exactly the same stage of development. The conclusion was unavoidable that these survivors were in the act of passing through the second moult at the time of treatment. This phenomenon of the resistance of ticks to arsenical fluids during the second metamorphosis appears to have escaped the observation of previous investigators. It may be worth while considering the circumstances surrounding the parasite at this stage.

The first question that presents itself is, in what manner is the arsenic absorbed into the body of the tick to produce its lethal effect? The theories advanced by different observers are:—

1. The tick absorbs the arsenic through its skin during dipping or spraying and the subsequent drying process.
2. The poison enters the skin of the beast, and from there it is absorbed into the body of the tick with the blood during the feeding process.

Laws* has shown by experiment that ticks actually decrease in weight when immersed in water, and deduces from this and other evidence that it is improbable that absorption takes place through the skin of the tick. On the other hand, the author of this article† has succeeded in killing ticks by the application of standard arsenical solution in the laboratory, and the experiments of Brünnich and Smith‡ at the Queensland Stock Experiment Station forced them to the conclusion that with a minimum of arsenic the combination of both the factors in question is required to produce lethal effect.

It will be seen then that both these conditions are considerably modified during the moult. Concerning the change from nymph to adult, Curtice§ says: "The moulting at this period is complete. The limbs and head are withdrawn a little from the old skin. The valves split along the sides, as in the earlier moult. The digestive, respiratory, and locomotory organs undergo little, if any, modification. The greatest change occurs in the reproductive organs, which have developed internally during the nymphal stage and assume their functions immediately after moulting, when the genital orifices appear in the new skin."

* *Agricultural Journal* of Union of South Africa, July, 1913.
† *Agricultural Gazette of N.S.W.*, Nov., 1914, p 937.
‡ *Queensland Agricultural Journal*, July, 1914.
§ Fuller, "Bovine Tick Fever," *Agricultural Gazette of N.S.W.*, 1896, p. 772.

Again, "The sexually-mature female tick reattaches herself on or near her original site."* Thus, during this period, the absorption of fluid through the skin of the tick is wholly or partly prevented by the outer or cast skin, and probably also a layer of air between the new and old skin, and the imbibition by the tick of arsenic-bearing blood or lymph from the cutaneous circulation of the host ceases altogether owing to the withdrawal of the mouth-parts. So that the difficulty in destroying ticks during the second moult is evident from theoretical considerations, as well as from experience in the field.

It is clear, then, that no matter what concentration of fluid is employed, one dipping cannot be relied upon to destroy all the ticks that a given animal may be harbouring. Now, when it is remembered that the period between the emergence from the second moult and the final detachment of the replete female from the host is only about seven days and sometimes less, the question of what interval should be allowed to elapse between the two statutory dippings of cattle leaving a quarantine immediately assumes the most vital importance. "After mating the female increases very rapidly in size, and has been known to have become fully engorged as early as forty-eight hours after the second moult, but usually at least four days are required for her engorgement. Commonly this period lasts from about a week to as long as twenty-five days."†

Another matter that presents itself is the effect of the treatment on engorged ticks immediately prior to detaching themselves preparatory to egg-laying. It might easily occur that a beast could be dipped during the period that elapses between the time the tick ceases to absorb nutriment and the moment of detachment. Some light is thrown on the subject by Laws,‡ who in discussing some aspects of the transmission of the tick-borne disease known as East Coast fever, attributes certain phenomena to the fact that though a tick may not actually be killed by the quantity of arsenic imbibed from the peripheral circulation, still a sufficient amount may be absorbed to render the tick sterile. In this connection, it may be pointed out that an apparently healthy engorged female tick, about to drop off a beast dipped at Oxenford three days previously in a solution containing 7 lb. arsenious oxide per 400 gallons, lived for twenty-two days subsequently in spite of cold weather. On the twentieth day she commenced to oviposit, but after six or seven eggs had exuded the process ceased and the tick was quite dead two days after.

Conclusions.

The conclusions to be drawn from the results of the foregoing series of experiments are:—

1. The Departmental dipping formula contains more arsenic than is required to produce the best results.
2. The Departmental mixture at full arsenical strength has intrinsically no deleterious effect upon cattle, including dairy cows in full milk.

* "Cattle Tick Pest," Bull. No. 13, Com. Inst. Science and Industry.
† "Cattle Fever Ticks," Bull 1,057, U.S. Dept. of Agr.
‡ "Ticks and Stock Diseases," Bloemfontein, 1916.

3. Arsenate up to 0·3 per cent. by itself, or up to 0·2 per cent. combined with 0·1 per cent. of arsenite, has no noticeably injurious effect on cattle.
4. Emulsion is not essential to a dip-fluid, provided the utmost care is taken to ensure the thorough wetting of every portion of the skin of the beast. As, however, this is impracticable in routine eradication work, the employment of emulsion is desirable for all ordinary purposes.
5. During the second-moult ticks are able to resist successfully the action of arsenical fluids at all commonly-employed concentrations.
6. Even at less than half "standard" arsenical strength, the only surviving ticks appear to be those undergoing the second metamorphosis at the time of treatment.
7. Arsenate possesses appreciable tick-killing power, probably about one-third that of arsenite.
8. Arsenical fluids appear to act more rapidly in summer than in winter.
9. In continuous dipping for eradication purposes treatment in weaker solutions at shorter intervals appears to offer brighter prospects of success than the present method.
10. Cattle leaving quarantine might advantageously receive two dippings, with a four-day interval, in a 5 lb. solution, instead of with a five- to ten-day interval in an 8 lb. solution.

Queensland Re-points a Sound Dairying Argument.

In the February issue of the *Queensland Agricultural Journal* is given an interesting review of the year's dairying operations in the northern State, not the least significant portion of which is the following passage concerning herd testing:—

"The daily average yield of milk of all animals tested is shown as 17·5 lb and the average butter fat per cent 4 1, while the average yield of commercial butter daily amounts to ·84 lb. The highest herd average recorded is 1·30 lb. commercial butter.

"If we compare a herd with an average production of 1 30 lb. commercial butter with a herd producing the average—viz., ·84 lb. commercial butter daily—taking the lactation as 300 days and both herds containing forty cows, the following figures are of interest:—

"Forty cows of the better herd produce 15,600 lb. of butter, while forty cows of the average produce 10,080 lb., a difference of 5,520 lb Taking butter at 1s. 6d. per lb, the best herd returns £1,170 against £750 for the poorer herd, a difference of 54 per cent. in favour of the better herd. If it were possible to improve the dairy herds throughout Queensland to that level it would mean roughly £4,000,000 sterling additional to the dairy-farmers of Queensland. While this may not be possible for many years to come, it should not be a very difficult task to raise the average production of our dairy herds by 25 per cent. Assuming that there are 400,000 dairy cows in the State, this would mean an approximate gain of £1,900,000."

Farmers' Experiment Plots.

Trials with Peas, Onions, and other Vegetable Crops, 1922.

Lower North Coast.

J. M. PITT, Senior Agricultural Instructor.

During the past few years there has been a very noticeable increase in the acreage sown to vegetables along the central coastal rivers. Farmers are gradually realising that the areas—and there are some of considerable size—can be more profitably used for vegetable culture than for some of the larger farm crops such as maize, millet, &c. In spite of a very decided increase in the area sown during the last twelve months there was still a shortage of green vegetables in the main towns except for very brief intervals, the shortage occurring much more frequently and for longer periods than the "gluts."

Trials with Peas at Taree.

A trial with peas had been conducted at the farm of Mr R. Dyball, jun., Taree Estate, in 1921, and although no weights were taken owing to the faulty germination caused by continuous rains shortly after sowing, the data collected was regarded as of sufficient importance to warrant the continuation of the trials.

In the following year, the season now under discussion, two plots were arranged—one with Mr. Dyball, and the other with Mr. J. Percy Mooney, Dumaresq Island, Taree. Uunfortunately heavy rain and flood waters partially ruined the latter plot and no weights were kept, but at Taree Estate the plot sown earlier had advanced sufficiently before the heavy rain arrived to escape damage, and from this plot some very interesting figures have been collected.

Following upon the good showing Greenfeast (a variety practically unknown in the district) had made in the 1921 trials, the sowings of this variety during 1922 were very considerable on the Manning, and so great was the demand for seed that seedsmen's stocks became exhausted long before the sowing season was over. The behaviour of Greenfeast in the experiment plot was even more noteworthy than in the previous season. It yielded far in advance of any other variety, gave a greater weight per given measure, and matured at least a fortnight earlier than Yorkshire Hero, the variety most widely sown. Further, it is a continuous cropper, and the pods are long, clean, well-filled, and attractive. On the two seasons' performances

1 INCH.

Senator. Greenfeast. William Hurst.

Varieties of Green Peas.

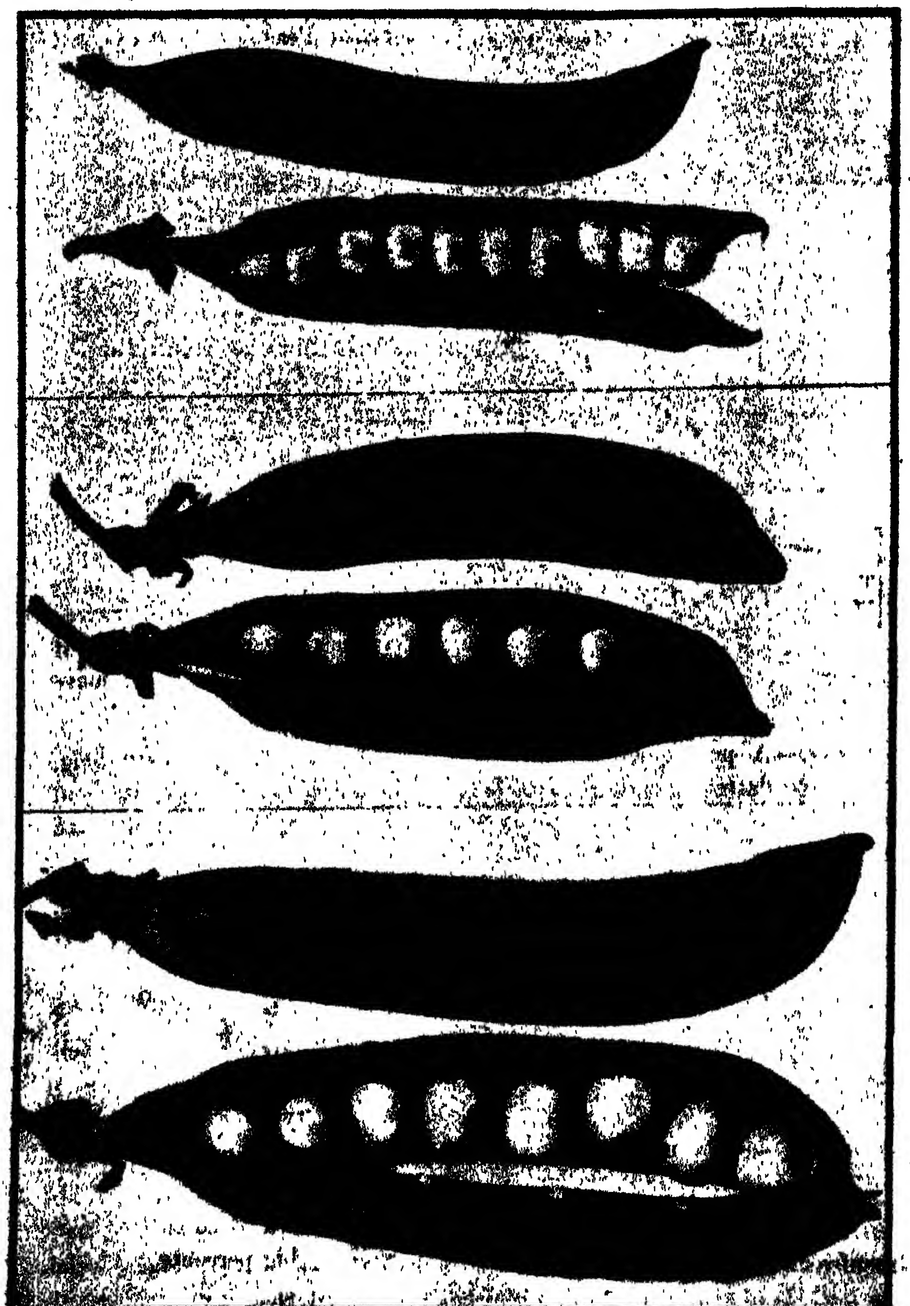
it has shown itself to be a variety well suited to the district, especially on the heavier loam soils, a fact which is also borne out by the greater number of farmers who grew it for the first time.

While the Yorkshire Hero type of pea has in the past been the most widely grown sort on the Manning, and still is on the Macleay River, it is noticeable (especially in the first-mentioned district) that this class of pea is fast being supplanted by the Wonder type, of which Greenfeast, Senator, and William Hurst are examples. Apart from the yielding capacity of the latter class, it has been brought under the writer's notice that in the glut season it is the only type that buyers (especially housewives) will purchase—a preference for which they can scarcely be blamed, considering that these kinds usually contain seven to ten peas in a pod, whereas the Heros rarely have more than six peas, averaging three to five. Such facts as these must necessarily have a marked influence on the varieties to be sown in future.

The pea is naturally a cold climate crop. On the North Coast it thrives, the greater part of the growth taking place during the winter and early spring months, and the plants hastening to maturity with the advent of hot weather. At the same time frosts have in some measure a detrimental effect, those occurring late (especially if at all severe) invariably destroying the pollen and "burning" the young pods, and in some instances completely spoiling that particular cropping, though the plants are seldom affected. Thus in districts like the Manning and Macleay, which are subject to both late frosts and early hot spring weather, it is obvious that maximum results are not always possible, and the range of varieties from which the very best results are probable is limited. It is safer, perhaps, to select from varieties that are neither too early nor too late.

The season under review forms a very good instance of extremes of temperature. During late September very severe frosts were experienced, and this had the effect of burning the pods and destroying pollen in the very early variety, very few pounds being harvested. On the other hand the temperature on a couple of days in October exceeded 100 degrees, the heat being accompanied by dry winds; this forced the late-maturing varieties into maturity sooner than would have been the case in a normal season, and reduced the yield. Varieties such as William Hurst, Greenfeast, and Richard Seddon, offer a good selection, while Yorkshire Hero, Hundredfold, Stratagem, &c., could be regarded as safe over an average number of years. The rainfall over the whole growing period was heavy, and although the surface soil was beaten down hard, and could not be worked, the growth throughout was good. As previously mentioned, owing to the quick arrival of hot weather, the fruiting season was short.

The soil on which the experiments were conducted was a rich, alluvial, stiff loam, previously cropped with tomatoes. The details of cultivation were as follows:—Ploughed three times, harrowed and rolled twice. Peas sown by hand 16th May, two seeds dropped every foot in drills 2 ft. 9 in. apart. Germination good, excepting Union Jack. Scarified twice before heavy rain in June. First peas picked 1st September.



Varieties of Green Peas.

Stratagem. Yorkshire Hero. Richard Seddon.

1 INCH.

The rainfall at Taree was:—May, 474 points; June, 189; July, 1313 (436 on 24th, 800 on 25th); August, 79; September, 1070; October, 151. The registration for July for Taree Estate was approximately 4 inches less than at Taree. The yields were as follows:—

YIELDS of Different Varieties of Peas.

Variety.	Bushels (28 lb.) per acre.	Weight of peas in pod to a given measure.*
		lb
Greenfeast	514	38
Senator	420	33
William Hurst ...	377	35
Richard Seddon ..	351	34
Hundredfold ...	351	33
Yorkshire Hero (average of two plots)	342	32
Daisy	334	31
English Wonder ...	291	34
Stratagem ...	257	30
Union Jack ..	Not weighed.	

* All the peas were weighed at the same stage of maturity.

Notes on the Varieties.

Greenfeast.—The pods of this variety are narrow, well and tightly filled, and the tip has a decided bend back. The pods carry eight to ten peas, of even size. It is stated by some growers that the pods are hard to remove from the vines.

Senator.—A pea somewhat similar to the above. The pods are long, narrow, and flatter, and slightly straighter. Peas number eight to nine, and are equal in size. Matures about the same time as Greenfeast, but although a good continuous cropper, does not bear so prolifically.

William Hurst.—Another Wonder type pea with long straight pods, slightly larger than Greenfeast, and containing seven to nine large peas. It matures about a week earlier. A continuous cropper.

Yorkshire Hero.—This variety is well known. It matures fully a fortnight later than Greenfeast. The pods are shorter and chubby, and are not well filled, four to five peas being the average. A continuous cropper In appearance there was very little between the two types grown, and the difference in yield may have been the result of a little difference in germination.

Hundredfold.—A very productive pea, maturing a week or so earlier than Greenfeast. Owing to its being affected by frosts a big percentage of the crop could not be harvested. Its position on the list should be somewhere about second. It is a chubby pod, 2½ inches long, and well filled with about six large even-sized peas. The pods are pale in colour. It is a moderately good cropper, and is well worthy of further trial.

Daisy.—A rank-growing, broad-leafed variety, maturing about the same time as Richard Seddon and William Hurst. A quite distinctive variety compared with any of the other peas tried. It is rather a shy bearer, there being very few pods in the first picking, but it continues bearing for a long period. The pods are enormous, measuring up to 6 inches in length, and are straight and deep. There are usually seven to eight very large peas present with a decided space between the peas.

Stratagem.—A late maturing, rather tall growing pea, coming in with Yorkshire Hero. The pods, however, are of the Wonder type; they are 4 to 5 inches in length, flattish, and contain seven to eight large even-sized peas. It is a continuous cropper, but not very prolific.

English Wonder.—This pea is somewhat similar to William Hurst, although appearing to mature a few days later. The pods are long, narrow, straight, and well filled with seven to eight peas. The pods illustrated have passed their best.

Richard Seddon.—A well-known pea, maturing second early. The pods are very similar to those of the Wonder type. They are long, straight, and contain seven to eight (in odd cases, ten) even-sized peas. It is a good cropper, and a very popular variety.

Union Jack.—This variety was the earliest of the lot. It is a dwarf pea, the pods being short and thick, and containing four to five good even-sized peas. Unfortunately only a few pods were harvested, frosts burning the young pods. This variety is not a continuous cropper, but in a favourable season the peas would command the highest prices owing to its being first in the market.

The Onion Trials.

In a report on onion experiments for the year 1920 (*Gazette*, April, 1921, p. 261), it was stated that during the statistical year 1918-19 only 335 acres were sown to onions in New South Wales, yielding 1,045 tons. The latest statistical figures available (1920–21) show that only 206 acres were under cultivation, yielding 907 tons—the central coastal districts contributing 30 acres for 91 odd tons. Considering that the onion plant is adaptable to so many parts of our State it seems remarkable that we allow other States to supply the bulk of onions for our markets. Along the Hunter and Manning and Macleay Rivers the acre-yields are the heaviest in the State, averaging 3 to 4½ tons, and in some instances over 6 tons to the acre, and yet the area sown would just about make a decent farm. Granting that the keeping qualities of the onions produced in these districts are not of the best, locally grown onions of long-keeping sorts can nevertheless be had from November until nearing mid-winter without any difficulty. Yet onions have to be imported into these districts throughout the year.

Of the more profitable of our farm crops taken over a number of years the onion stands alone. There may be odd years when tomatoes, cabbages, or cauliflowers will bring better returns, but as a sure money-maker the onion is superior.

Figures supplied for last year's crop by Mr. Dyball, junior, Taree Estate, from about 1$\frac{3}{10}$ acre show that approximately £100 was taken. Most of the early lots were sold in the bunch (three onions in a bunch) at 2s. 6d. per doz. bunches, while the main portion of the crop was disposed of from 10s. to £1 a cwt. On many occasions higher prices than these have been realised, very seldom less; and this farmer has only had two failures with his onion crop during the last fifteen years.

Flat Red (4).
Prizetaker (4). Barletta (3). Long Keeping Brown Spanish (3).
Market Model (2). Hunter River Brown Spanish (2). Light Brown Spanish (4).
Ailsa Craig (5). Odourless (6).
Varieties of Onions from Mr. B. Dyball's plot.

Taking into consideration that the year was one of the driest on record, and that only one spray irrigation (a late one) could be given, the plant previously being out of action, and bearing in mind that the plot contained many trial varieties, some of which yielded poorly, the result must be regarded as highly satisfactory.

The dry spring made hand working extremely light, weeds being entirely absent, consequently a run through the crop with the single-horse cultivator now and again was all that was necessary. Incidentally it may be mentioned that the onion on the season's performances showed extreme drought-resisting qualities. This was in a measure due to the care taken in the preparation of the plot—the cultural treatment helping to conserve the rains that had fallen earlier in the year. The rainfall for the station nearest the plot was 189 points in June, July 1,313, August 79, September 1,070; and over the two most important months, October and November, 151 and 12 points respectively. Practically none of the November rain fell on the plot.

The previous crop had been tomatoes in the spring. This crop left the land in good condition. Prior to planting out, the bed received three ploughings, harrowings, and a rolling to bring the ground into the fine tilth necessary for the young plants. The seed had previously been sown in a well-prepared seed-bed during March, being sprinkled evenly over the surface, and watered-in carefully with a can with a fine rose attachment, and a thin layer of dry manure sieved over the top, to keep the surface loose and moist. The germination was perfect As an instance, 3,234 plants were planted out from an oz. packet of seeds of the Odourless variety.

The young plants of all varieties maintained a good growth throughout, and were ready for planting out in June. Drills were lined out 2 feet 9 inches apart (to allow for single-horse cultivation), and the young plants put in at the average distance of eight to the yard. As a proof of the hardiness of the young onion plant, it may be stated that although the tops and a good portion of the roots were nipped off, and the plants set at the rate of 800 per hour each by the grower and his sons, hardly a plant failed to strike. Owing to dry and frosty weather, the early growth was slow. In fact, a noticeable feature throughout was the scanty top-growth, long periods of dry, hot winds being responsible. One irrigation, a late one, was given with the overhead spray, the plant previously being out of action. All varieties would have benefited by further applications.

The outstanding feature in the yields was the remarkably heavy yield of the Odourless onion. These onions were even and clean, ranging from $3\frac{1}{2}$ to 5 inches in diameter, and averaging half a pound in weight throughout the plot. Odd specimens weighed a pound. The yields were as follows:—

YIELDS of Different Varieties of Onions.

Variety.	Yield. t.	c.	q.	Variety.	Yield. t.	c.	q.
Odourless	10	12	3	Prizetaker	3	11	1
Early Barletta...	7	7	0	Ailsa Craig	3	10	0
Hunter River Brown Spanish	7	4	1	Long Keeping Brown Spanish	3	2	3
Light Brown Spanish... ...	5	7	3	Lord Howe Island	2	13	2
Market Model...	3	13	2	Flat Red	2	2	3

Notes on the Varieties.

Odourless.—This is an onion of a brown colour, flattish in shape (about 1½ to 2 inches in thickness), and of attractive appearance. Although not entirely free from the onion smell, it is certainly very mild. The "leaves" of the bulb are rich and fleshy, and are white in colour and excellent flavour. To obtain such a remarkable yield under the conditions speaks well for the variety.

Early Barletta and Hunter River Brown Spanish are both well known varieties. The former is an extra early, large, white, flat-growing, mild-flavoured type, suitable for "bunching." Storage qualities very poor. The bulbs were not as large as the 1921 crop. The latter is a brown-skinned, globe-shaped onion, rather strong flavoured, fairly early, and a moderately good keeper. Yielded well. Hunter Rivers were a very nice even lot of bulbs. Both lots found quick sale, Barlettas being much sought after.

Light Brown Spanish.—A variety not previously grown in the district. Gave a nice average-sized lot of bulbs, clean-skinned and attractive. It is fairly early and worthy of further trial. Appears to be a fairly good keeper.

Early Flat Red.—A reddish-brown tinged onion, thin-skinned, rather small, semi-globe shaped (there were many elongated bulbs). Termed "early," but the latest in the lot to mature. Nothing wonderful.

Market Model, Prize aker, Ailsa Craig, Long Keeping Brown Spanish— There was very little difference in the yields of these varieties—all are popular varieties of good quality, Ailsa Craig being perhaps the most attractive. Each plot yielded some very nice medium-sized bulbs. All were no doubt affected by the dry season. They mature slightly later than those mentioned previously.

Lord Howe Island—An early onion of reddish-brown colour, not quite as dark as Flat Red, clean-skinned. Yielded poorly No outstanding features.

Other Vegetable Crops.

Trials were conducted with other vegetables during the autumn, but unfortunately the very wet autumn and winter months spoilt the experiments. A few notes were collected, however, which may be of interest:—

Cauliflower.—White Queen, Late Italian Giant, Autumn Giant, Eclipse, Asiatic, and Phenomenal. All spoilt by rain and aphis.

Cabbage.—St. John's Day, Drumhead, Succession, Pedigree, and Burpee's All Head. Mostly spoilt by rain and moth. Drumhead, Succession. and Pedigree were the best.

Turnip.—Garden Swede, Purple Top, Purple Top Aberdeen, Laing's Purple Top Swede, and Imperial. Purple Top were fit first, and some nice turnips of Garden Swede, Imperial and Laing's were also harvested.

Lettuce.—There was a marked difference in the two strains of Neapolitan tried, one being more a large leaf type, early and somewhat uneven, and the other a little later, smaller and inclined to heart more. Cabbage lettuce were

a nice even lot. Boston and Deacon were large good sorts. The demand for the smooth-leaved varieties is not as keen as for the crinkled sorts.

Beet.—The strains of Egyptian and Globe were very similar, but one strain of Egyptian was more flattish than the other. All did well. There is always a big demand for beetroot.

Rhubarb.—Topps' Winter did well.

Eschalot.—Both lots of eschalots gave good results, yielding an immense number of bulbs.

TO CONTROL THE MONOLEPTA BEETLE ON COTTON.

THE Yellow Monolepta beetle (*Monolepta rosæ*) is proving a serious pest on the cotton crop on our North Coast. The damage caused by this beetle has in some cases been astounding; crops in the Casino district that were green and healthy and about 3 feet high have been ruined in two or three days. The beetle has attacked cotton all over the district from the Tweed River to the Bellinger, and perhaps even further south. It has also been observed eating the silk of the maize cob, and on orchard trees, mulberry, pepper (introduced), teak (native), and the weed popularly known as Stinking Roger.

Many farmers have been confusing this beetle with the pumpkin beetle. The latter is red, with black spots ; the Monolepta beetle is slightly smaller, and yellow in colour, with a bright cerise red patch on each shoulder. This pest of cotton is very hardy and extremely lively on the wing ; it is easily disturbed and extremely hard to deal with by ordinary methods.

Of the various means of control tried during the last few weeks, however, one has proved very effective. It was found that if the beetles were disturbed at night, and a strong light was exposed in their vicinity, they would fly towards the flame. A bag was therefore tied loosely to a long handle, soaked in kerosene and ignited, and carried slowly between the rows of cotton, two or three other persons keeping close to the operator meanwhile and shaking the adjacent bushes. The more assistants the better, and the brighter and bigger the flare the more effective. It is not necessary for the operator to walk along all the rows ; the beetles will be found in communities, and these should be located just before dark and again with the flare, the operator and his assistants remaining in the neighbourhood of each community in turn until all the beetles are destroyed. The flare should be kept very bright by the addition of kerosene at frequent intervals, and the bag renewed when necessary. When shaken off the bushes the beetles fly in myriads through the flame and fall to the ground, and the path of the operator will be marked by thousands of dead beetles.

Two things are essential for success: There must be plenty of helpers in close touch with the operator, and the flare must not be allowed to lose its brilliance. If the beetles are noticed when first they make their appearance in a field, a single night with the flare will be sufficient to destroy them ; but if they are more thoroughly established, the flare should be used for two or three consecutive nights. This method of dealing with the pest would doubtless be equally effective in an orchard.

Mr. W. W. Froggatt, Government Entomologist, has pointed out that a power naked lamp could be used similarly to the kerosene flare. Cocoanut beetles feeding on the under-surface of the palm-leaves have been treated similarly in the New Hebrides.—E. S. CLAYTON, Agricultural Instructor.

Some Suggestions on Spray Management.

[Continued from page 208.]

W. J. ALLEN and W. LE GAY BRERETON.

A Mixing Plant.

THE methods of mixing some of the more common sprays as described last month save much time when mixing during spraying operations, but to get full advantage of a power or tractor outfit the mixture should be carted out to the outfit at the scene of operations as previously described, and under such circumstances it is necessary to have an arrangement by which the carter can prepare the mixture quickly and single-handed. At Glen Innes Bordeaux mixture is only used in small experimental quantities, and there is not a plant for dealing with larger quantities, but Mr. Broadfoot, the present Orchardist, set up a mixing plant for the purpose of illustration (see Fig. 9). In this case advantage was taken of the stand supporting an overhead cistern, which provides the water for mixing, which in turn is filled by a windmill from a stock tank with an ordinary paddock catchment; but where this is not available a site can sometimes be selected at the back of the bank of a tank or dam as seen in Fig. 10. The water is supplied through the 2-inch hose shown in Fig. 9, which will quickly fill any of the casks. The spray outfit in use is of 80 gallons capacity, so arrangements were made to supply that load, but the load should of course be altered to suit the orchardist's particular requirements. As sufficient 80-gallon vats were not available, the mixing had to be done in two separate 40-gallon lots. This required four casks—two for holding the diluted bluestone solution and two for holding lime mixtures. Each of these casks must be capable of holding 20 gallons each; they should be marked at opposite sides on the inside at that level, and provided with a large outlet tap (about 1¼ inches) at the bottom. These are set in pairs of one bluestone with one lime on the top platform, as shown in Fig. 9. Two more casks are necessary, each capable of holding 40 gallons; these are placed on a second platform, as seen in Fig. 9, so that the contents of each pair above can be run into them. These lower casks should be marked on opposite sides on the interior at the 40-gallon level, and should also have large outlet taps at the bottom so that their contents can be run into the tank of the supply cart below through a strainer. It will be seen by this that the carter can do all the mixing efficiently and quickly without help. He first measures in the respective casks the right quantities of bluestone solution and lime mixture, then fills the top casks to the 20-gallon mark with the hose. He then stirs the lime in the one pair of casks, opens the taps of this pair, and keeps the lime stirred while the two are running into the cask below. The running in of the two keeps the resultant mixture stirred sufficiently during the operation, but on completion it must be given a violent stirring, and

it should also be noted whether it has come up to the 40-gallon mark. The operator then does the same with the other pair of casks, completing the 80-gallon load. The mixture should be kept stirred while it is running into the supply cart.

It is possible to dispense with the mixing casks shown on the lower platform, and to mix direct into the supply cart, but there are advantages in retaining them. The straining can be done when running the completed

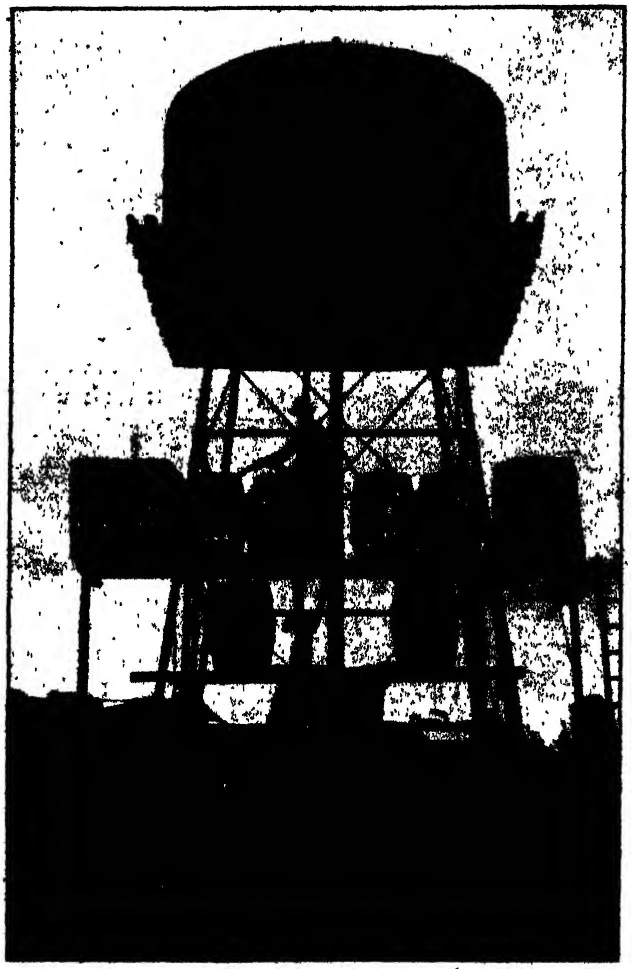


Fig. 9.—Mixing Plant for making Bordeaux mixture rapidly, though single-handed.

mixture from the lower casks to the supply cart, whereas if it is done while running the lime and bluestone together coagulation often occurs at the strainer, with either causes splashing over or necessitates waste of time in running the solutions in very slowly. Moreover, though it is generally recommended that Bordeaux mixture should not be kept over long periods, it nevertheless takes a little time for the chemical reaction to be completed, but this time can be allowed without loss if, after the first load has

been made and run into the supply cart another lead is mixed and left to mature while the first load is taken out; then when it in turn has been loaded another load can be mixed and left.

The mixing plant for Bordeaux mixture can be increased in capacity by adding more casks according to the number of spray outfits to be supplied.

Agitation of Spray Material.

Perfect agitation of spray material during pumping is most important with many mixtures. This is seldom if ever attained with hand-pumps; the power-pump gives better opportunity, but even power outfits are sometimes defective in this respect. Moreover, even where perfect agitation is attained an important point is often overlooked. The agitator is connected with the pump and only starts working when the pump is put into

Fig. 10.—The back of the bank of an ordinary stock tank, or dam, is a convenient spot for a plant for mixing Bordeaux mixture.

operation, and a few strokes or revolutions are necessary before the spray material is thoroughly stirred, whereas the pump starts drawing on the first stroke; hence with material like lead arsenate (which settles rapidly), if the spray mixture is not stirred just before the pump starts it will draw up some of the thick mixture from the bottom before the pump agitator has completely stirred it, and the first lot to go on will be stronger than is desirable and the remainder weaker. This can be overcome in some cases by attaching an independent agitator, which can be operated without causing much delay before the pump is started, or by providing a fair-sized circulating pipe connected to the delivery pipe of the pump and between the pump and the cut-off taps where the lengths of hose connect. This pipe should be provided with a cut-off tap and lead back into the tank of the outfit. Before starting the pump this cut-off tap is opened and the first-mentioned

taps closed, so that the mixture first taken up by the pump quickly passes back into the tank to be mixed by the agitator. After a few strokes, and when the mixture has been thoroughly stirred, the tap of the circulating pipe is shut and spraying started.

This method causes very little delay, but to try to do the same thing thoroughly by placing the nozzles in the tank takes a lot of time.

Though motor spray outfits have been very generally adopted, one occasionally still meets a grower who, while his area easily warrants the installation of such an outfit, is deterred from introducing it by fear of the unreliability of such an outfit and consequent trouble. Doubtless some outfits are better than others, but very often trouble is caused by lack of reasonable care. In this connection a short account of the outfit at Glen Innes orchard may be of interest.

The outfit was obtained in July, 1914, the representative of the firm supplying it spending an afternoon in instructing the orchardist and his staff, none of whom had had any experience with internal combustion engines. The engine was simple in design and could be operated almost by rule of thumb, and as absolutely nothing went wrong for about twelve months the users learnt nothing beyond the fact that the machine would not go without fuel. In the second season the machine began periodical mysterious stoppings and though it would start again readily it was a little time before one of the staff detected the cause of the trouble to be failure of the ignitor points to close again after an ignition. This was due to too much lubrication to a certain part. The instructor had said, "Give very little," but the little that had been given had proved too much, and after that none was given at that point at all. Our point is that this first trouble was entirely due to lack of experience on the part of the operators and could not be charged against the machine.

The following is a list of the repairs that required the attention of a trained mechanic or purchase of duplicate parts during the eight years the machine was in operation:—

Breakages.	Cause.
1. Two new sprockets for agitators.	An accident.
2. A new overhead crank shaft for pump.	Neglect to clear out accumulated sediment in recess at bottom of pump cylinders.
3. Welding of pump standard.	An accident.
4. A new relief valve for pump.	Fair wear and tear.
5. A pair of new plungers for pump.	Fair wear and tear.
6. About six minor springs, which were listed at 1s. to 1s. 3d. each, and now would probably cost from 60 per cent. to 70 per cent. more.	Fair wear and tear.

Nos. 1, 2, and 3 should not be counted against the outfit, as they were due to clumsiness or carelessness. As to No. 5, the same wear has occurred in hand pumps during the same period, and although probably a greater quantity of packing for the pump was used a greater quantity of work was got through than with a hand pump in the same period. The expense of

springs over eight years is not worth mentioning. During this time the outfit was not kept to look at, and though the orchard consists of only a little over 20 acres, a large proportion is planted to aphis-liable apples. Roughly, the spraying schedule at this farm is as follows:—General dormant spray of either oil or lime-sulphur; a fungicide spray on the apples and pears before blossoming; three lead arsenate sprays (with or without fungicide combined); many tests that entail independent applications of fungicides; from two to three applications of woolly aphis sprays in the early part of summer; often test sprays on stone fruits; a general "clean-up" woolly aphis spray at the end of the fruit season, which on the large trees takes up to 10 gallons.

There is no doubt that some outfits are more reliable and give less trouble than others (of even perhaps the same make), and there is no doubt, too, that the outfit referred to above is one of the good ones; but the writer attributes the satisfactory results obtained with it very largely to the careful oversight and lubrication it regularly received. No parts have been taken to pieces nor adjustments made except when necessary, and special precautions have been taken against budding mechanics. The machine has never been run over her specified speed, and finally—but by no means least important—one of the staff (No. 1 in Fig. 5), who was present at the installation, has generally been in the spray team when the machine has been working.

Where several outfits are required on large areas it would be worth while to have a foreman hand, fully experienced in the class of machine in use, whose sole duty it would be to keep an eye on all the outfits; also a repair equipment fit for minor repairs, and a spare outfit to avoid delays from breakdowns at critical times. The aim should be to have the outfits all of one pattern to simplify the matter of duplicates and repairs.

(*To be continued.*)

Graze off the Paddymelons.

While it is a pleasing sight in the southern districts at the present juncture to see any green tinge on the paddocks, the pleasure is distinctly qualified when the green tinge is derived from a healthy crop of paddymelon vines (*Cucumius Myriocarpus*) growing on otherwise excellent fallows.

The spectacle is not a rare one, but the weed should be eradicated at once. To do this by cultivation necessitates the use of some type of disc cultivator, and while it is so dry this is not a desirable method, as it tends to render the surface too fine. If a farmer has sheep—and what wheat farmer in the Riverina has not?—he should put them on the fallows immediately, and, by the shortage of other feed, force them to clean up the paddymelons. If resorted to at once the method will, in most cases, be found satisfactory.—L. S. Harrison, Senior Agricultural Instructor.

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant National Herbarium, Botanic Gardens.

Prostrate Spurge (*Chamaesyce prostrata* [Ait.] Small; *Euphorbia prostrata* Ait).

(*Euphorbiaceæ*: Spurge Family.)

Botanical Name.—*Chamaesyce,* derivation uncertain; *prostrata,* lying upon or trailing along the ground.

Popular Description.—A small bluish-green plant, growing flat on the ground, with small, roundish leaves, and minute green flowers. It is similar in habit and general appearance to the native Caustic weed, *Euphorbia Drummondii,* a plant which is usually the first to appear in pastures and old cultivation paddocks after a drought. Seed capsules very small, slightly hairy on the back; seeds oblong, grey or black, rough.

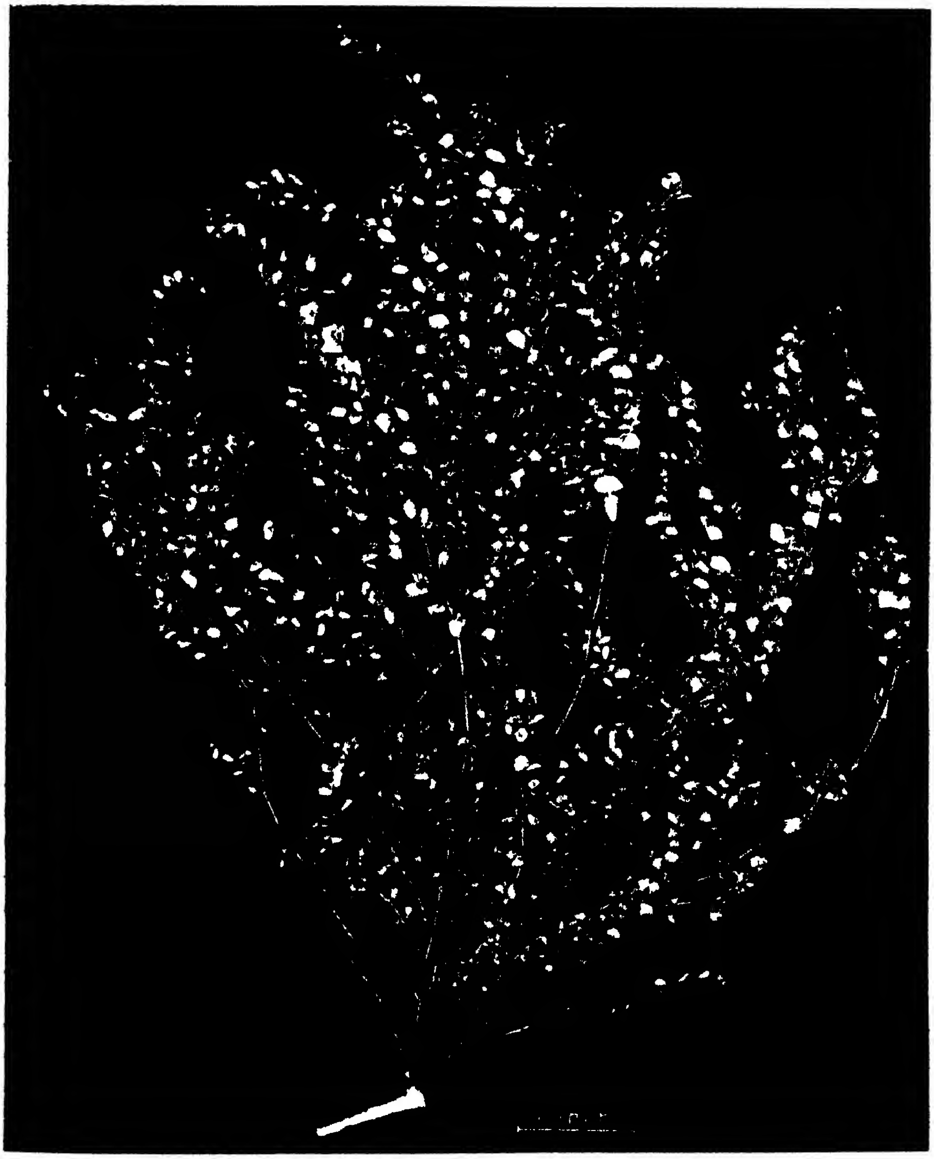
Botanical Description.—A slender, prostrate or spreading, branched, nearly glabrous annual herb, the stem 6 to 12 inches in length, usually pubescent along one side. Leaves small, short-petioled, elliptic to obovate, rounded, base inequilateral, margins sharply toothed, 5-8 mm. long. Involucres axillary, pedicelled, intermixed with reduced leaves. Capsules glabrous except for the hispid-ciliate keels of the cocci.

Where Found.—It is a native of tropical America, and now widely distributed throughout the tropics and many islands of the Pacific, notably, the Marshall Islands, Nauru and Ocean Islands, and [illegible]. In New South Wales it is only known from Petersham, near Sydney.

It was probably introduced into this country with superphosphates, as it is apparently common in Nauru and Ocean Island, from whence large quantities of superphosphates are imported.

Character as a Weed.—Prostrate Spurge has the persistent characters of *Euphorbia Drummondii,* and like that plant, when once established it takes years to eradicate it. In tropical countries it flowers and seeds all the year round, and is regarded as a tenacious weed of pastures, large gardens, roadsides, and cultivation generally. Caustic weed has been suspected at various times of causing mortality in sheeep. Prostrate Spurge, no doubt, possesses similar properties to Caustic weed, but so far its properties have not been investigated.

Eradication.—Prevention of seed development by cutting off plants as they appear, and the total destruction of any seed-laden plants, are means by which this weed may be eradicated. Plants of this kind should not be left about where they are cut, as they usually contain much seed; they should be removed from the ground as quickly as possible, before the seed capsules have had time to become dry and scatter their contents.



Prostrate Spurge (*Chamaesyce prostrata* [Ait.] Small)

Thyme-leaved Spurge (*Chamaesyce thymifolia* L.; *Euphorbia thymifolia* L.).

(*Euphorbiaceæ*: Spurge Family.)

Botanical Name.—*Chamaesyce,* derivation uncertain; *thymifolia,* thyme leaves, from their resemblance to the leaves of the thyme.

Common Name.—Creeping Spurge, Thyme-leaved Spurge, Nayeti.

Popular Description.—A slender prostrate hairy annual, usually with reddish stems 6 to 12 inches in length. Leaves small, ovate to oblong, blunt. Flowers very small. Capsules hairy, three-angled, about 2 mm. in diameter. Similar in habitat and appearance to the species just described, but more hairy.

Botanical Description.—An annual, spreading or prostrate, much branched, slender, pubescent herb, the stems usually reddish, up to 12 inches long. Leaves opposite, distichous, somewhat oblique, elliptic to oblong, obtuse, obscurely crenulate, 4-7 mm. long. Involucres about 1 mm. long, purplish, in in the axils of much reduced leaves or bracts or crowded short branchlets from the leaf-axils. Capsules hairy or pubescent 3-angled, about 1½ mm. long.

Where Found.—A native of the tropics generally; abundant about towns and waste places in the Philippine Islands; common throughout the greater part of India and Ceylon, ascending in Kashmir up to 5,500 feet; often a conspicuous object as a weed on gravel walks.

It is a new weed for the Commonwealth, and at present it is only known from the Sydney district.

Economic Uses.—According to the "Dictionary of Economic Plants of India" (Watt), the juice of this plant is known to be a violent purgative. The dried leaves and seeds are aromatic and astringent, and used in native practice in diarrhœa and dysentery of children along with butter-milk (Murray). Irvine says that it is common everywhere, and is used as a stimulant and laxative. In the Southern Concan, according to Dymock, the juice is used for the cure of ringworms (hence its name "nayeti"), and mixed with ammonium chloride to cure dandriff O'Shaughnessy says that the juice of the stalks and flowers is a violent purgative; that the fresh plant is applied by the Arabs to wounds, and the leaves and seed given by the Tamuls in case of worms and in the bowel affections of children.

Fodder Value.—The only reference that I can find to its fodder value is that it is eaten by camels and goats in India.

Character as a Weed.—It is similar to Prostrate Spurge in every way.

Means of Control.—As for the preceding species.

Spotted Spurge or Slobber Weed (*Chamaesyce Preslii* [Guss.] Arth., *Euphorbia Preslii* Guss.)

(*Euphorbiaceæ*: Spurge Family.)

Botanical Name.—*Chamaesyce,* already referred to; *Preslii,* probably named in honour of J. S. Presl.

Common Name.—Pasture Spurge, Spotted Spurge, Slobber Weed, Stubble Spurge, Eyebright—the latter because of its effect on stock.

Thyme-leaved Spurge (*Chamaesyce thymifolia* L.)

Spotted Spurge or Slobber Weed (*Chamaesyce Preslii.* (Guss.) Arth.)

Popular Description.—A slender graceful plant, with round, wiry, reddish stems and short-spreading branches, 6 inches to 2 feet or more high. Leaves narrow, oblong to oval, slightly curved, ½ to 1 inch long, often with unequal sides, and reddish, finely-toothed margins, sometimes with a reddish-brown blotch in the centre; in autumn the whole plant turns a dull crimson. Flowers small, often nodding. Seed capsule smooth; seeds grey or brownish, rough, more or less four-angled. The seeds are often found in grass and clover seed.

Botanical Description.—Erect, slightly pubescent, spreading annual, 6 to over 24 inches high. Leaves subsessile, rounded at the base, somewhat cordate, oval-oblong or linear, obtuse or acute, serrate, somewhat trinerved at the base. Stipules reddish, triangular, ciliate Cyme oligocephalus, somewhat dense, corymbose, terminal, supported at the base by the upper leaves. Involucre long, turbinate, glabrous, the inside hirsute, lobes lanceolate, glandular appendage white, rounded-ovate, the lobes entire or obtuse; styles shortly bifid, capsule glabrous; coccis obscurely keeled; seeds blackish, triangular-ovate, transversely and irregularly rugose

Where Found.—Indigenous to North America, where it has an extensive range. The only record we have of this weed for the Commonwealth is from Ashfield, near Sydney, but it is not known how it got there.

Character as a Weed.—In North America it is a weed of wheat land, pastures, roadsides, and waste places. It usually makes headway when the wheat, oats, or clover is well advanced, and at a time when the crop needs all the moisture it can get to develop the grain; therefore the Spurge is a menace to the growing crop at the critical period of development. Its presence is most noticeable about harvest time, when its reddish stems show up against the ripening grain. After harvest the stubble becomes quite red with the weed.

Poisonous Properties.—The following reference to the physiological action of the common spurge (*Euphorbia Preslii*) by Dr. True is extracted from the "Manual of Poisonous Plants" (Pammel), p. 603:—

Headache, with frontal fullness and heat; heat about the eyes; languor and drowsiness; oppression of the stomach; and constipation. The juice applied to the eyes causes severe irritation, with smarting, and burning, lachrymation and momentary blindness; this we have experienced twice whilst gathering the plant It is supposed that this species causes the affection in horses called "slobbers."

Means of Control.—The following method of control is suggested by Ada Georgia in the "Manual of Weeds," p 265:—Burn over infested stubble in order to kill the stalks and destroy the seed on the surface of the ground. On cultivated ground, persistently hoe-cut or hand-pull the weed before the seed manures. Infested meadows should be put to some well-tilled crop, liberally fertilised, before re-seeding heavily to grass or clover.

IN Denmark the important part which root crops play in successful winter dairying is shown by the fact that the area under mangolds, swedes, and turnips has increased from only 95,000 acres in 1888 to 330,000 acres in 1901, and 678,000 in 1919; in 1918 nearly 10 per cent of the total acreage of crops and grass was under these crops. JAMES WYLLIE, in the *Journal of the Ministry of Agriculture*, London.

Poultry Notes.

April.

JAMES HADLINGTON, Poultry Expert.

During the early months of this summer, when the hot, dry weather set in and difficulties in the growing of green feed were seen to be inevitable, many were the lamentations that disastrous results would follow a shortage of succulent green feed for the birds. It was feared, for instance, there would be a lack of development in the growing stock, and that egg-production would be on a low scale. As a matter of fact, judging by what has been observed, neither has one or the other of these prognostications been verified. This is more particularly noticeable with regard to egg-production, which has kept up above the general average for summer months.

All the indications are that better laying results have been obtained during this summer than for a number of years past, and this notwithstanding that the supply of succulent green feed has been intermittent, and in some cases has failed altogether. It has become an article of faith among poultry-farmers that poultry must have green feed—that it is one of the essentials to successful poultry-farming—but looking back over past experiences, the writer has at times, when running thousands of fowls, been absolutely without succulent green feed for the birds for months together, and nothing very alarming has happened, nor has there been any very greatly reduced egg-production during such periods.

Taking all in all, the poultry-farmer will find that dry weather in itself is not the worst enemy to his interests in so far as egg-production is concerned. The biggest factor under droughty conditions is the curtailment of ordinary poultry food supplies, and the extra demand for certain foodstuffs commonly used by poultry-farmers, caused by the feeding of dairy and other stock upon these same lines, the effect being a rise in the cost of feeding.

The Function of Green Feed.

The dry conditions prevailing and difficulty of procuring greenstuff, have produced requests that several questions regarding green feed should be dealt with in these "Notes."

The first of these is whether green feed is absolutely necessary and to what extent it will take the place of other foods for poultry? In reply, it might be said at once that succulent green feed. with the exception of lucerne (which may be mentioned as representing the best food of the kind for poultry), is too bulky to have anything but very little feeding value for poultry. The fact is that even in the case of lucerne—and much less so with other green crops—the birds have not the capacity to eat sufficient of it to make any very material addition to the nutritive dietary.

In feeding succulent green feed it is not so much the feeding value that is sought as the vegetable salts and vitamines contained therein. Milk, for instance, is one of the most nourishing and most natural of foods, providing always that the animal concerned can consume a sufficiently large quantity of it, but the quantity a bird can take would mean absolute starvation unless a very substantial amount of other food materials was added. Yet, owing to the vitamine principles contained, even the small quantity that can be fed is a very valuable adjunct to the food of poultry, particularly to growing stock, although, of course, both young and old birds can do without it.

Lest the above statement with regard to vitamines should be misunderstood, and since we are now familiar with statements made by scientists that growth and even life itself cannot be maintained apart from the supply of these vital principles in the foods, be it explained that it is fortunate that practically all the combinations usually fed to poultry contain vitamines A (fat-soluble) and B (water-soluble). In regard to poultry these are of greatest importance.

It can therefore be stated, as a matter of experience and in conformity with the science of feeding, that even though both milk and green feed be withheld, both life and health can be maintained.

The Small Food Value of Greenstuff.

One has only to imagine how small an amount of dry matter would be contained in a handful of green feed when evaporated to see that it can form but an infinitesimal value in comparison with a handful of wheat, maize, or pollard.

Many cases come under the notice of the writer where too large a proportion of green food is added to the morning mash, apparently on the principle that anything that is eaten will fatten, unmindful of the small amount of nutriment that may be contained in the food. As has often been pointed out, if a hen is to maintain her full laying capabilities she must be well fed, and to a large extent on concentrated foods. In short, she has not the stomach of a cow or horse to deal with large quantities of roughage.

The fact to be borne in mind in this connection is that the hen's own bodily requirements in the way of nourishment must be met to maintain her in health and strength, and she must also have a surplus with which to nourish the oöcytes (rudimentary eggs). Not only so, but any shortage in nutrition will cause re-absorption of the oöcytes that may be already in an advanced stage of development.

Hence it is that a shortage of food, or deficiency in nutriment, however caused, will result in low production, as indicated in last month's "Notes."

Succulent *versus* Dry Lucerne.

The next question is to what extent, if any, dry lucerne in the form of meal or chaff will take the place of the succulent green article. There appears to be no entirely satisfactory answer to this question, nor is it a simple matter to determine except in terms of food value, which is not the issue.

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The poultry-farmer is therefore thrown back more or less upon experience and on a common-sense view of the matter. In the absence of any authoritative statement based upon research work, it can only be said that experience and probabilities are against the assumption that dry lucerne is a complete and efficient substitute for greenstuff. The loss of vegetable salts, and possibly of vitamines, during the drying process is the reason assigned for this conclusion. At the same time, lucerne meal, dust, or chaff is regarded as very helpful in the absence of the green article.

This statement of the case is not, however, intended to detract from the value of lucerne meal, lucerne dust, or good lucerne chaff, as a poultry food. These articles are valuable items of food for poultry, and can be fed in conjunction with pollard, bran, wheat-meal, oaten pollard, rice pollard, linseed meal, and such like products, to as high as 20 or even 30 per cent. of lucerne to the other ingredients of the mash.

The difficulty in connection with the use of so large a percentage as one-third, is that with wet mash it makes it somewhat crumby, and is likely to cause waste. To get over this difficulty, it is suggested that a proportion of at least one of the articles mentioned, other than pollard and bran, be used to bind the mash; if so desired bran can be entirely eliminated. The food value of good lucerne meal is roughly equal to that of bran. Therefore one can be substituted for the other with but slight disturbance of the balance of the ration. Lucerne meal or chaff should be made from good leafy hay and not from old stalky stuff.

Green Maize.

Another query is with regard to the use of green maize in the absence of a better class of green feed. Green maize in its young succulent stage, and when chaffed fine, is permissible as green feed, but its value is much less than that of lucerne, both in regard to its succulence and its feed value. In fact, it is an inferior article for this purpose in any stage, but perhaps better than none at all. In its later stage of growth, when it becomes obviously fibrous, it is probably worse than nothing, and if too far advanced it is positively harmful. It is not a good green feed for incorporation in the morning mash, and is much better fed by itself.

A leaflet entitled "Green Fodder for Poultry: a Supply all the Year Round," is available without charge. Applications should be addressed to the Under Secretary and Director, Department of Agriculture, Sydney.

Importance of Shell Grit.

Some amateur breeders of poultry get the impression that broken crockery, crude lime, and even gravel, will take the place of good shell grit, but it is a serious mistake. Primarily poultry eat grit to supply the material for making egg-shell. Hence it is that during the flush season of laying large quantities are consumed, while in the slack laying period there is a very considerable falling off in the quantity consumed. The action of grit, of course, as an aid to digestion in all bird life is not overlooked, and for this purpose almost any sharp grit will answer; but not so in the case of mineral matter

that is required for shell-making. This must consist of sea beach or oyster shell, preferably two-thirds of the former to one of the latter. Clam shell is, of course, included in sea shell.

The grit supply has an important bearing upon egg-production, and hens deprived of it soon cease to lay. It is not sufficient that shell grit be supplied spasmodically. It must be kept constantly before the hens, preferably in boxes, which should be placed in sight of the attendant, so that the chances of the birds being left without it are minimised.

Some American Conclusions Concerning Swarm Control.

In Farmers' Bulletin No. 1,198, United States Department of Agriculture, G. S. Demuth discusses the factors contributing to the tendency of bees to swarm and the best means of prevention. He submits the following as the most important preventive measures :—

1. Careful selection of stock in breeding.
2. The use of brood chambers large enough during the spring brood-rearing period to hold the maximum amount of brood without crowding.
3. The use of good worker combs in the brood chamber to prevent a reduction of the available brood-rearing space.
4. The arrangement of the brood combs to avoid barriers in the way of a free expansion of the brood nest during the spring,
5. Providing extra space for the bees within the brood chamber by wider spacing of combs and a deep space below the frames.
6. The use of large entrances during the swarming season, especially when the weather is hot, and in some cases additional openings for ventilation.
7. Protection of the hives from the direct rays of the sun by the use of shade boards or double covers.
8. Painting the hives white, especially the cover, if a shade board is not used.
9. Management to prevent conditions favourable to the building of barriers of sealed honey around the brood nest, or the breaking up of barriers of this kind if they already exist.
10. Inducing the bees to expand into and occupy supers as rapidly as the honey flow will justify during the first half of the honey flow, or at the time the colony is rapidly expanding in numbers.
11. Providing additional space in the form of empty combs for the ripening of incoming nectar, so that the field bees can immediately dispose of the nectar they bring into the hive, to prevent the beginning of any stagnation of the activities of the colony.
12. Removing some of the emerging brood to reduce the number of emerging bees within the brood chamber, thus producing a better distribution of the bees throughout the hive.
13. The destruction of queen cells, provided they have been started but recently. Frequently, however, other cells are immediately started after the queen cells have been destroyed.

As a remedy for swarming, the bee-keeper relieves the congestion of bees within the brood nest by creating conditions comparable either to the swarm or to the parent colony in nature.

The Banana Aphis.

(*Pentalonia nigronervosa* COQUEREL.)

W. W. FROGGATT, F.L.S., Government Entomologist.

THIS remarkable aphis was described and figured by the French entomologist, Coquerel, in the *Annales de la Société Entomologique de France* in 1859. It was found infesting the bananas growing at St. Denis (Ile Bourbon).

In this original description he formed the Genus *Pentalonia*, of which it is the type, and defined the very distinctive venation of the wings. Describing the species he says :—" Of a reddish brown colour, clearer on the head. Antenna, nervures, and cornicules blackish ; legs yellow, with the base of the femora, tibiæ, and tarsi black." In the plate he figures the adult female aphid, the thickened antenna, and the end articulations of this same antenna greatly enlarged

Nothing further was recorded regarding this aphis until 1909, when H. F. Wilson contributed a paper to the *Journal of Economic Entomology* (Vol. II, p. 346), illustrated with woodcuts of the winged and wingless forms of the insect, and a scientific description. He identified Coquerel's species and says :—" A species of Aphidæ has been found very abundantly on banana plants in the greenhouses of the United States Department of Agriculture, and was no doubt imported on banana from some country where the fruit is grown." In her list of " The Food Plants of the Aphidæ of the World," Miss Edith Petch lists *Pentalonia nigronervosa* as a banana pest.

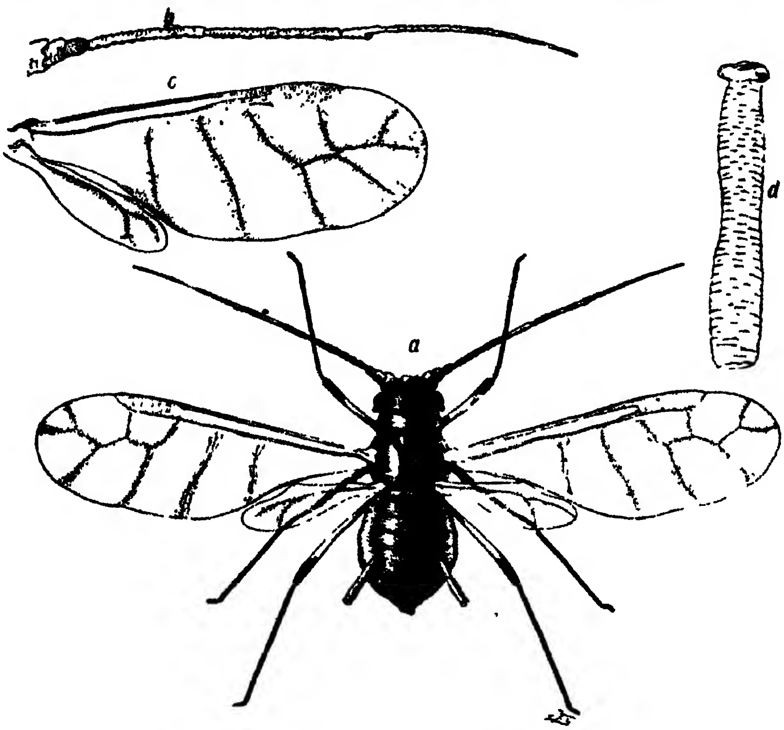
On my last visit to the Tweed River, New South Wales (November, 1922), I obtained a fine series of the aphis upon the banana stems in Mr. Marks's plantation. These I forwarded to Mr. E. Zeck, of the Artists' Branch of the Government Printing Office, who for some years has been carefully collecting and noting the coloration and structure of the many species of Aphidæ found in New South Wales. With the aid of his knowledge of the family, I was able to look up the literature dealing with this species, and to establish the identity of the specimens obtained on the Tweed River.

Both the winged and wingless forms are very small creatures, and to the ordinary observer they appear to be dark brown or black, but, on examination under a lens, it will be seen that the general colour is reddish brown marked with black, and that in the adult winged forms the nervures are delicately outlined with black. It was on account of this that Coquerel gave this banana aphis the very appropriate specific name of *nigronervosa*.

A great deal of importance has been attached to this banana aphis infesting the plantations in the Tweed River district, because it has been claimed by some growers that the presence of these insects indicates that the nfested banana will later on be attacked by " bunchy top "—the mysterious

disease that is causing so much damage to the banana crops on the Northern Rivers of New South Wales and Southern Queensland. It is claimed that if the banana aphis is eliminated by spraying all the infested plants with kerosene emulsion or some other reliable mixture the plants will not develop bunchy top.

There can be no question that aphis infestation, if allowed to go untreated, will affect the well-being of any plant or tree, and the banana aphis does a



The Banana Aphis (*Pentalonia nigronervosa* Coquerel).

a, winged viviparous female; *b*, antenna; *c*, wings; *d*, cornicles. (*a* enlarged, *b*, *c* and *d* greatly enlarged.)

[*After Wilson.*

considerable amount of damage to the growing plant by sucking up the sap of the leaf tissue. The writer is very doubtful whether banana aphis infestation is a direct cause of bunchy top in bananas; and, until fresh evidence in support of the contention is brought forward by plant pathologists, we certainly have no proof. There are probably quite a number of other causes—climatic conditions, cultivation, soil, &c.—that all contribute to the development of bunchy top.

DR. Pol Demade, of Brussels (states the *International Review of the Science and Practice of Agriculture*) has studied the effect of goats' milk in the nourishment of invalids, and found that its use reduces the cases of infant gastro-enteritis by 50 per cent.

April Work in the Apiary.

W. A. GOODACRE, Senior Apiary Instructor.

THIS is the month during which final preparations for winter are generally attended to. There are districts, however, where such work may still be deferred, for in the warme· climates it is not unusual for the bees to carry out active work during April. In a few localities conditions are so mild even during winter that the bees are able to store honey and the apiarist to extract a fair quantity of surplus, but with the exception of these parts it is fairly generally found that with the advent of the heavier frosts the season is concluded, and conditions are cold enough to put an end to any further progressive work in the hives.

There is a vast difference between the methods of wintering bees in this State and those employed in colder countries, where the temperature may descend below zero. All wintering of bees here can be carried on successfully out of doors, and without use of the aids needed in colder climates. We are fortunate in not having to provide cellars for the hives, or to go to the expense of the packing cases or double walled hives that we hear so much about elsewhere. Many beginners purchase text books dealing with conditions as they exist in other countries, and the idea conveyed of the trouble experienced in wintering bees is rather startling to them. Some of our best works on bee culture come from outside, but the beginner should get well acquainted with local conditions so that allowance can be made for the difference in climatic conditions as they exist here.

A colony of bees in a good condition for successful wintering fulfils the following demands:—(*a*) A good cluster of bees raised under normal autumn conditions with a young queen in company; (*b*) an ample supply of good food; and (*c*) a good sound hive that is waterproof, and has walls of sufficient thickness to allow the warmth provided by the cluster of bees to be retained. The question of obtaining a good force of young bees for winter was dealt with in last month's notes. There is a good deal of discussion among apiarists regarding the wintering qualities of certain honies, but to take a broad view of the matter, there is very little honey gathered under natural conditions that is not good for wintering bees on. Some say that the bloodwood honey is superior for winter stores, but in the writer's opinion the good results are due not so much to any peculiar quality inherent in bloodwood stores, as to the fact that the stimulation provided by the bloodwood flow in the late autumn gives the colonies a better chance to prepare fully for the winter, an ample force of young bees thereby being raised, and the colonies put into the right spirit. Similar cases might be cited.

The size of the hive for wintering bees in also comes in for a fair amount of discussion. Some apairists prefer to remove all the supers but one from the populous hives at the close of the season, wintering the weaker stocks in a ingle full-depth brood chamber. In this matter, however, much depends on

the condition of the colony and the quantity of stores in the hives. In our climate, if there is a large force of bees, it does not generally appear to interfere with good wintering if a few supers containing honey are left on the hives; but where the hives are well stacked up with empty supers it is advisable to remove a sufficient number to allow of greater comfort for the bees. For a fair-sized colony, there should be 20 lb. or more of stores in the hives for winter; the bees will not consume much through the cool weather, but to induce a good start in the spring work a fair quantity of surplus is desirable. It must be remembered, moreover, that a colony with a small supply of stores during winter will economise in the use of the honey, and this will have an effect on their vitality. Weak stocks should always be wintered in small hives, and there is nothing like placing a good frame of honey on each side of the small cluster to keep the bees comfortable and compact. Colonies well established on from three to four frames, if conditions have been normal during the autumn, can usually be brought through the winter in good order if care is taken.

Feeding for Winter Stores.

While in the majority of districts this season, the bees should obtain sufficient winter stores from the fields, in a number of localities it seems evident that food will need to be supplied by artificial means. Honey is the natural food, but where no honey from a source free of disease is available sugar syrup may be supplied as a substitute. To prepare this mix equal quantities by volume of cane sugar and water, and bring (stirring meanwhile) just to boiling point. Allow this to cool and feed to the bees late in the afternoon. Use fairly large feeders, and once a start is made get the feeding work over as soon as possible, so as to prevent undue stimulation. In cold climates a heavier syrup than the abovementioned can be supplied.

The Feeding Period for Bee Larvæ.

For the first three, and in some cases four, days after hatching, the worker larvæ are fed with a predigested food called "chyle food," which is prepared in the chyle stomach of the worker bees. After this first feeding period, a food made heavier by the addition of honey and pollen is supplied. An interesting item with regard to this late feeding was observed during the past month at the Government Apiary. A comb containing brood in various stages of development, was removed from a hive and kept under a temperature of 85 degrees, when it was noticed after a time (about one hour) that a number of practically full-grown larvæ became restless in their cells, and extended their heads over the cell wall, with a distinct movement in the mouth parts and every indication that they were asking for food. Other larvæ of lesser growth were curled up in their cells and quite content.

The question of the relation of the feeding of the larvæ and the development of disease presents interesting aspects. It seems quite probable that in such diseases as American foul brood (*Bacillus larvæ*) and sac brood, in which the majority of the larvæ die after being sealed, the spores of the disease may be fed at a fairly late stage of the larval development.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Wheat:—

Bomen	H. M. Hall and Sons, Studbrook, Cunningar.
	E. J. Allen, Gregra.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Canberra	Hughes Bros., Greenacres, Pullabooka, *via* Grenfell.
	H. M. Hall and Sons, Studbrook, Cunningar.
	W. W. Watson, Woodbine, Tichborne.
	E. Idiens, Boorowa.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	T. M. Slattery, Mirrool.
	E. J. Allen, Gregra.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
Canberra (ungraded)	Manager, Experiment Farm, Condobolin.
	Meurant Bros., Cundumbul, Molong.
Cleveland	Manager, Experiment Farm, Bathurst.
	W. Burns, Goongirwarrie, Carcoar.
	A. J. Rial, Wolseley Park.
College Purple	Hughston Bros., Hughstonia.
Currawa	Hughston Bros., Hughstonia.
Federation	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	R. McCrone and Son., Bungambil, Mirrool.
	T. M. Slattery, Mirrool.
	Hannett Bros. and Wilson, Wellville, Cunningar.
Firbank	T. M. Slattery, Mirrool.
Florence	Manager, Experiment Farm, Glen Innes.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Bathurst.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	E. J. Allen, Gregra.
Hamel	Manager, Experiment Farm, Temora.
Hard Federation	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	N. Campbell, Glasleck, Curlewis.
Improved Steinwedel	Manager, Experiment Farm, Temora.
	W. W. Watson, Woodbine, Tichborne.
Major	Manager, Experiment Farm, Temora.
	Hughston Bros., Hughstonia
Marshall's No 3	Hobson Bros., Glenlea, Cunningar.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	A. J. Rial, Wolseley Park.
Penny	W. W. Watson, Woodbine, Tichborne.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.

Wheat—continued.	
Rymer	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Sunset	Manager, Experiment Farm, Coonamble.
Thew	H. M. Hall and Sons, Studbrook, Cunningar.
Union	Manager, Experiment Farm, Temora.
Wandilla...	Manager, Experiment Farm, Temora.
Warden	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	W. W. Watson, Woodbine, Tichborne.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
	Hughston Bros., Hughstonia.
	B. J. Stocks, Linden Hills, Cunningar.
Yandilla King	Manager, Experiment Farm, Bathurst.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Hobson Bros., Glenlea, Cunningar.
	Hughston Bros., Hughstonia.
	E. Idiens, Boorowa.
	A. J. Rial, Wolseley Park.
	Hannett Bros. and Wilson, Wellville, Cunningar.
Yandilla King (ungraded) ...	W. V. Herbert, Bongalong, Muttama.
Oats:—	
Algerian	Gollasch Bros., Pine Park, Milbrulong.
Guyra	Manager, Experiment Farm, Glen Innes.
Mulga	Manager, Experiment Farm, Glen Innes.
Sunrise	Gollasch Bros., Pine Park, Milbrulong.
White Tartarian	Manager, Experiment Farm, Glen Innes.
Barley:—	
Chevalier	A. J. Rial, Wolseley Park.
Kinver	Manager, Experiment Farm, Temora.
Pryor	Manager, Experiment Farm, Temora.
Trabut	A. J. Rial, Wolseley Park.
Lucerne:—	
	W. E. Myring and Son, Pallamallawa.
Tick Beans:—	
	D. Cameron, Mount George.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

Soil Nitrogen and Livestock Farming.

Interesting comparative experiments in livestock farming and the direct utilisation of various crops have been carried out at the Agricultural Experiment Station, Wooster, Ohio. The rotation followed is maize, soybeans, wheat, and clover. Each area receives 2 tons of ground limestone and 700 lb. of 16 per cent. acid phosphate per acre, per rotation. In the first system all the crops except wheat are fed to livestock or passed into the manure as bedding, and the manure is applied to the maize crop; in the second, the maize, soybeans, and wheat are removed and sold, the hay and straw being left upon or returned to the land; the clover is not harvested, but allowed to stand until ploughed under the following spring. The experiments show the superiority of livestock farming, which increases the crop production and the nitrogen content of the soil.

Orchard Notes.

April.

W. J. ALLEN and S. A. HOGG.

Harvesting.

The work of harvesting, particularly late varieties of apples, will be continued until the end of this month. It is not customary to export our late varieties of apples, as they are remarkable for their keeping quality and consequently may be readily disposed of in the local markets. These late varieties extend to a very material extent the breeding period of the codlin moth, and it is therefore advisable that they should always receive special attention after the midseason apples have been disposed of. Care should be taken to go round the trees and remove any moth-infested apples, and if there is any sign of fresh infestation it may be advisable to give an extra spraying with arsenate of lead.

With regard to the keeping of the essentially Australian apple known as Granny Smith, various methods and devices have been adopted. From experience it has been found that this apple keeps best—apart, of course, from cold storage—in an open shed where there is a constant circulation of air, or even in the shade of pine trees. If this apple is picked carefully and placed in heaps in the shade of pine trees it should keep for a period of at least two or three months, even though it may be exposed to the rain. It may be noticed that by nature it has a thick waxy covering which seems to be sufficient protection even when it is exposed, providing it is kept in the shade.

This being more or less a slack period in the apple orchard, time may be devoted to the bandages on the apple trees, if they have been applied, and to thorough examination of the trunks and branches of the trees. Any grubs or pupæ which may be found should, of course, be killed.

Picking and Packing Ohanez Grapes for Export.

Practically the only other fruit available for harvesting this month will be Ohanez grapes. This grape has been exported to England with varying success, but where it has been carefully handled and well packed the prices realised have been quite satisfactory. It may be useful to give a few hints on the picking and packing of this variety.

Ohanez grapes should be picked in the cool of the morning, and then spread on trays in the shade for about twenty-four hours before being packed. All broken and unmatured berries should be removed, and portions of the bunches should be cut away so as to allow the bunches to lie flat when packed. These portions should be used to fill up the spaces.

Special attention should be given when handling this fruit. It should be handled by the stalk, and as little as possible of the bloom should be removed from the berries; the bloom not only lends attractiveness, but, as it is of a waxy nature, it greatly assists in the preservation of the fruit.

From reports received from the agents in London, it is suggested that Ohanez grapes should be packed in a case other than that recognised in this State as the grape case. In fact, small barrels are suggested and preferred. If these should not be available, it is suggested that the fruit be packed in Australian bushel cases. The case should be lined with tissue paper, then ½-inch of cork dust should be placed on the bottom of the case, and the fruit packed evenly and firmly, leaving a small space between the bunches and the sides of the case, say ½-inch; now pour in some more cork dust, and shake it until all the apertures are filled; again cover the fruit with cork dust to a depth of ½-inch and repeat the operation until the case is filled. It takes about 12 to 15 lb. of cork dust per bushel case.

Citrus Planting in Frost-free Districts.

Young citrus trees may be planted this month. Special care should always be taken in handling citrus trees, particularly oranges, for although they are very hardy once they are established, if not carefully handled during removal (that is, from the nursery to where they are required to be planted) they very readily receive a check, and it takes them a considerable time to recover. For instance, in handling young orange trees the roots should never be exposed to the air; that is to say, when they are removed from the nursery they should be puddled or completely balled with damp earth. Any broken roots should be trimmed and special care exercised to prevent planting citrus trees at too great a depth. Take care that the union, that is, where the tree has been worked—either budded or grafted—is well above the ground. The trees should never be planted to a greater depth than in the nursery. This can easily be detected by the colour of the bark, as the exposed part of the bark becomes a dark green and the unexposed remains a light yellow.

Having placed the tree firmly in its position, it will be found an advantage where possible to apply at least a bucket of water to each plant. If the young plants in the nursery have grown to a height of 2 or 3 feet they should be shortened to within 15 inches of the ground. As the exposed bark of citrus trees is very subject to sunburn, care should be taken to protect it with bagging, or the like, until such time as its branches form a natural protection to the trunk.

Take care to keep the soil well loosened in the immediate vicinity of the trees, and if they are planted where irrigation water is available, see that the furrows are run so close to the trees that the land between each furrow becomes thoroughly saturated. It has been noticed that the inexperienced irrigator seems quite to overlook the fact that young trees require moisture close to the butts, and not 2 or 3 feet away, as the trees are not furnished with long roots at this stage.

Scale Insects on Citrus.

Although it would have been preferable to have had these trees cleaned up during the months of January, February, or March, rather than neglect them altogether, the work should be immediately taken in hand. Fumigation

is certainly the most successful method of keeping scale in check, but as the appliances for this operation are not always available and the initial cost is somewhat heavy, the grower may fall back on the sprays recommended by the Department, leaflets regarding which may be obtained on application.

Final Processing of Prunes.

Prunes which have been treated and gone through their first dipping process, followed by curing, should by this time be in a nice condition for their final handling. If a particularly attractive article be desired, such a variety as Robe de Sergeant is greatly improved in appearance by adding sufficient glycerine to the final dip (a weak saline solution kept at boiling temperature), to keep a thin film on the surface, through which the prunes are immersed and removed. The Silver prune and Fellemberg would also be improved by similar treatment.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date
Richmond River A. H. and P. Society (Casino) ...	P. M. Swanson ...	Apr. 10, 11, 12
Bulladelah Agricultural Bureau	F. Coleman ...	„ 12, 13
Wellington P. A. and H. Society	A. E. Rotton ...	„ 17, 18
Moree P. and A. Society	C. G. Hobbes ...	„ 17, 18, 19
Upper Manning A. and H. Association (Wingham)...	D. Stewart ..	„ 18, 19
Clarence P. and A. Society (Grafton)	L. C. Lawson ...	„ 18 to 21
Auburn Branch Agricultural Bureau	J. J. Pratt ...	„ 21
Warialda P. and A. Association	Lanagan Bros. ...	„ 24, 25
Ulmarra P. and A. Society	R. N. Shaw ...	„ 25, 26
Dungog A. and H. Association...	W. H. Green ...	„ 25, 26, 27
Dubbo P. A. and H. Association	F. Weston ...	„ 26, 27
Coonamble P. and A. Association	J. C. Wilson ...	May 1, 2
Maclean P. and A. Society	R. D. Munro ...	„ 2, 3
Narrabri P. A. and H. Association	E. J. Kimmorley..	„ 2, 3
Hawkesbury District Association (Windsor) ...	H. S. Johnston ...	„ 3, 4, 5
Junee P. A. and I. Association	T. C. Humphrys ..	Aug. 21, 22
Murrumbidgee P. and A. Association (Wagga) ...	F. H. Croaker ...	„ 28, 29, 30
Culcairn P. A. H. and I. Society	L. H. M. Newton.	Sept 4, 5
Young P. and A. Association	T. A. Tester ...	„ 4, 5, 6
Cowra P. A. and H. Association	E. P. Todhunter...	„ 11, 12
Gunnedah P. A. and H. Association	M. C. Tweedie ...	„ 11, 12, 13
Holbrook P. A. and H. Society...	J. S. Stewart ...	„ 18, 19
Ganmain A. and P. Association	T. S. Henderson...	„ 18, 19
Northern A. Association (Singleton)	J. T. McMahon ...	„ 20, 21, 22
Narrandera P. and A. Association	W. H. Canton ...	Oct. 4, 5
Lismore A. and I. Society	H. Pritchard ...	Nov. 20, 21, 22

1924.

Society.	Secretary.	Date
Central New England P. & A. Assoc. (Glen Innes) ..	Geo. A. Priest ...	Mar. 11, 12, 13
Campbelltown A. Society	J. T. Deane ...	„ 28, 29

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Agricultural Gazette of New South Wales.

Farming as a Business.*

A. H. E. McDONALD, Chief Inspector of Agriculture.

A GREAT deal of time and money has been spent by the Department of Agriculture and the press in seeking to bring about improvements in farming practice, and their efforts have been crowned with a considerable amount of success. While it is important that farming methods shall be improved, it is equally important that the farmer, besides being a good farmer, shall be a good business man. Very little has been done, however, to assist him in this respect. The success which has been achieved in the improvement of farming practice however, justifies the hope that once attention is seriously directed towards securing improvement in the business of farming, fairly rapid progress will be made.

It is satisfactory to note that on the agenda paper is a motion having for its objective the securing of estimates of cost of production. If each farmer were able to show just what it cost him to produce his crops it would be of great value, as the average cost of production could be determined: and if his costs were compared with his neighbours, it would become apparent where his business management was weak, and improvement would then be possible.

Farming is very complex in character: it is a profession, a business and a trade. On the professional side, the farmer decides after taking into consideration all the factors, what methods will be likely to yield him the best crops. As a business man he then decides to what extent these methods may be adopted, and also sees that the organisation on the farm is such that operations proceed smoothly; he buys and sells and attends to all the other details of management. As a tradesman, the farmer actually performs the labour which is required profitably to utilise the knowledge he possesses and his business capacity.

In large business organisations, such as factories, specialisation is practised, and men are employed with the requisite knowledge or skill in the various sections. Thus a professional chemist is employed to devise new processes, a business manager is engaged to direct operations, while labourers are employed to carry out the actual process. It is apparent, therefore, that a farmer who runs his farm practically singlehanded, cannot be successful unless he not only knows when to plough and sow, but is also able to perform the work of ploughing and sowing and further is qualified as a business man to direct operations. Incidentally this necessary triple qualification explains how it is that business men frequently fail as farmers; but that is not proof that business acumen is not essential to success. It is needed more perhaps in farming than in any other trade or profession, as, in this State at any rate, most trades

* Paper read at the conference of western branches of the Agricultural Bureau held at Parkes on 11th, 12th, and 13th April, 1923.

are so organised that a price can be fixed for a commodity based on cost of production, while the farmer must, as a rule, take what the market offers. He is forced to rely upon his capacity as a business man to reduce costs of production and of selling to a point below what he can obtain for his produce, rather than to make his selling price fit his cost of production.

Unfortunately, farmers are, as a rule, poor business men, and they are forced to make up by their sweat what they lack in this direction. It is just as well to be plain, for recognition of the fact will lead to improvement. Some are fairly keen at buying and selling, particularly in stock, but this is after all a fairly simple matter.

A System Required.

If a farm is to be run on business lines, the farmer must be capable of analysing critically all the operations and factors which affect the returns, so that he will be able to detect where improvements may be made. To do this thoroughly, some simple but complete system of keeping books is necessary, but unless a system can be devised which can be adopted without taking up too much time, it will not be practicable, as no farmer has the time to devote to books during the day, nor the inclination for the task at night. Such a complete system, whilst possibly desirable, is not essential to the running of the farm on business lines. Simple calculations and constant scrutiny of the various operations will quickly show where improvements are possible.

Business Methods Mean Increased Profits.

I will now proceed to indicate briefly a few of the ways in which more efficient business management will influence the profits. These, for the most part, have been gathered from actual experience in farm management or from observations in the course of visits to farmers.

A farm cannot be considered a success unless it pays a fair rate of interest on the money invested in land and plant, and enables a fair return to be obtained for all labour put into the operations. It must also return sufficient to cover depreciation charges. On most farms the heaviest charges are those of interest and depreciation.

The area that can be worked profitably by a farmer is that which he can himself cultivate and harvest. It is therefore necessary for the farmer to ask himself whether his farm is large enough to enable him profitably to work it, or whether it is too large. If it is good grazing country, it is possible that the land not actually required for cultivation may, after paying interest and rates, leave a profit, but in most cases in good farming districts the land is so valuable that it is not profitable to use it for grazing. In such cases the land which cannot be cultivated is a burden, and the owner would be getting more money if he had his capital invested otherwise. One hears frequently of the accretion in values, but such accretions are, as a rule, only appreciable when they are realised upon quickly. In other words, when compared with the returns which would have been obtained from money actively invested, they are, when taken over a period of years, disappointing.

In Sydney, we hear a great deal of the increase in land values, but over a period of years they run only from 5 to 8 per cent. and anyone who has held the land has had in addition to pay rates and taxes.

Land is largely bought and held for sentimental reasons, but often it is paid for dearly. Sentiment often also operates to the detriment of the farmer's business in other directions. An instance is the desire to own many horses In ancient days, a man's wealth was gauged by the number of his cattle, and this primitive custom still prevails to a large extent. On some farms there are many useless horses. These cost money to keep and each farmer, as a business man, should ask himself if they are returning a profit. Roughly, it can be taken that a horse will take the place of about ten sheep, and the value of these can easily be estimated. Probably to the farmer, a sheep is worth at least £1 per year. Is each horse that is kept on the farm worth £10 to him ? Another direction in which the farmer may look for losses is in the quality of his working horses and other stock. If his horses are a poor lot, probably he has to use ten where eight good ones would do the work; that means two useless horses for which feed must be provided and on which time must be wasted in harnessing and in attention. The cost of these two is more than £10 per year each as they are not only using up feed but also valuable time. These seem simple things but I think we all know of farms to which they apply.

Then there is the loss which occurs in connection with machinery. This is a most expensive item and next to the land charge is the one which does most to keep farmers poor. A heavy interest charge has to be faced, while depreciation is also considerable. In the first place, does a farmer always confine his purchases of machinery to such as are necessary to enable him to cultivate his land and harvest his crop ? I must confess that the attitude of many farmers in this respect is very puzzling. I have seen the greatest haste in buying expensive machinery that was quite unnecessary for the particular crop that was to be harvested, while the same man would not spend a few shillings to buy a barrel in which to treat seed wheat for smut.

Again, there is the mystery of clearing sales, especially those held just after a bountiful harvest At these it is a common experience to find articles which are practically worn out, bringing higher prices than new articles of the same kind. Restraint is one of the principles of business, and full value for money expended is another, but unfortunately both are frequently overlooked by farmers.

Business management takes in the methods which are adopted on the farm and the kind of crops grown. Certain general principles are laid down in regard to farming. Fallowing and the manuring of the soil are sound practices generally, but each farmer has to decide for himself how far he can adopt them on his own farm. He has to satisfy himself that they will pay. This he can do only by adopting sound business methods. First let us suppose that instead of fallowing he grows some crop, such as Sudan grass, for sheep feed. Whether this pays as compared with fallow will depend

upon whether he has bred the right kind of lambs to feed upon it, whether he has grown sufficient crop to fatten his lambs, and lastly upon his direct business capacity in securing the best possible price for his lambs.

Food Production on the Farm.

It is well for a farmer always to bear in mind that he is operating his farm to make a living for himself and his family, and it is not always good business to turn all the products of the farm into money with which to buy food for his family. It is also as well for those who are not farmers to realise that if a farmer does produce some of his own food on the farm, it is not raised for nothing. Nevertheless, while it does pay a farmer to specialise to a considerable extent, just as it does other business men, still he can, in many cases, do a great deal better by devoting part of his time and money to raising food for himself than in raising something to sell. Some farmers consider that it does not pay to raise fruit and vegetables, but when they are seen purchasing canned fruit or jams for a shilling, of which the actual value of the fruit is about one penny, some doubt is raised. At any rate, it is worth while considering whether it would not pay to devote, say, half a day a week to the vegetable garden or orchard, and to invest a hundred pounds or so in a water supply for the same purpose. After all, about the most we can get out of life is plenty of good food and clothing, and a farmer invests several thousands of pounds in a farm to enable him to earn sufficient money to buy these.

Systematised Farming.

The farmer who is a business man will conduct his farming operations systematically; he will run it as a business rather than as a speculation, with the object of securing a fair return each year, rather than run the risk of failure, in the hope that by speculation on the season he will get a big return. In the more southern districts, the necessity for the adoption of such a course is recognised, but it must be admitted that in the western and northern districts the soundness of the principle is only just being realised. The success which has been attained by Mr. Watson, of Tichborne, who is a thorough business man in this respect, indicates the advantage of following a business-like system.

Insurance.

This leads to the question of insurances. Unfortunately, it is not possible to insure against all losses, and the farmer is at a disadvantage in this respect as compared with other business men. It is, however, possible to secure insurances to some extent; buildings and machinery can be insured against fire, while crops may be be covered against hail and fire. In view of the issues involved, it is certainly desirable that farmers should adopt the business-like course of effecting these insurances. Unfortunately, it is at least questionable whether the farmer always obtains a fair deal in regard to cost of insurance, and of compensation against loss. This, however, is also a matter of business; the farmer will not get a fair deal in this as in other

matters until he becomes sufficiently business-like to manage his own affairs, either personally or by building up an organisation that will handle the more complex matters of business for him.

Records and Correspondence.

No business can be conducted satisfactorily if records are not kept, or if correspondence is not conducted on proper lines. Most business men have little time to waste, and their greatest bugbear is a letter covering several pages, especially when the most important part is left out. Business letters should be short and to the point, but must contain all the information that is required to enable satisfactory service to be given. Proper records should also be kept of all important transactions. Frequently disputes arise in regard to receipt of goods or of payments, and these can be easily adjusted to the satisfaction of all the parties when the record of the transaction can be produced.

Perhaps the most important part of the farmer's business is the selling of his produce, and the buying of his requirements. If he has to buy his goods at the highest price and sell his produce at the lowest, he is not going to be successful. This is such a complex subject that I can only refer to it here. Wheat-growers and dairymen have at last got into the position where they are getting something like a fair price for what they sell, but many other producers, notably fruit-growers and potato-growers, are far from getting a favourable price for their produce. It is doubtful whether any farmers are getting at reasonable prices what they buy.

Rural Credit and Co-operative Societies.

Having indicated some of the directions in which business acumen will lead to greater success, I wish briefly to refer to how this knowledge may be acquired. There is no better way than the formation of rural credit societies and the development of co-operative buying and selling. By these means direct benefits will be obtained, while the indirect advantages accruing from the development of business instinct and business methods will be very great. While the tangible benefits will be of considerable importance, I venture to think that the indirect benefits will be vastly greater. These societies will directly enable farmers to arrange their finances on better and cheaper terms, and will also place them in a position to buy and sell to the best advantage. By means of the opportunities they will afford to the farmer to acquire good business methods, they will also have the effect of considerably increasing the returns from the land, while at the same time the costs of production will be reduced.

There are a few who doubt whether these schemes are practicable: but when we cast our minds back over a period of not so many years, and note the improvements in business methods and farming practices during that time, no other conclusion can be reached than that farmers will quickly adopt schemes which possess so many advantages and which, indeed, are essential if farmers are to continue successfully to operate under the stress of

present day conditions. Each farmer must continue to operate his own farm; but what he needs, and can have, is reliable expert assistance in arranging his finances and in buying his goods and selling his produce. An organisation can be built up on the foundations of rural credit and co-operative societies which will enable him to command the markets of the world. Many of us can remember the wretched days of barter—when we took our eggs or chaff or grain to the store and received goods in return. We had a form of barter in many parts of the State not so many years ago. We have progressed much in a comparatively short time; at the best though we have but an imperfect control of the selling price of produce, even in our local markets.

Co-operative organisations give full control of the markets, and offer the only means by which farmers can secure control over the sale of their produce in overseas markets.

A Farmer's Experience with Mulga Oats.

The following was received by the Department from Mr. E. R. Hill, Adelaide-street, Blayney:—"An interesting experiment was conducted last season by Mr. A. G. Kinghorn, near Blayney. A block of 7 acres of Mulga oats, sown at the rate of 1½ bushels per acre, being the second crop on new ground, harvested 70 bushels to the acre: 7 acres Algerian oats, in the same paddock, grown under similar conditions, harvested 55 bushels to the acre. The crops were grown on stubble, unmanured. The yield exemplifies the benefit of the Department of Agriculture's efforts in producing the Mulga oat, and instances the possibilities of the Blayney district for oat-growing."

The Comparative Feed Value of Different Cuts of Lucerne.

In experiments carried out over a number of years at Utah Agricultural Experiment Station to determine the best time for cutting lucerne, it was found that as regards the amount of increase in live weight produced on a given area, the relative value of the cuts was as follows:—Early cut (immediately after flowering), 100; average cut (one week after flowering begins), 71. Cattle fed with lucerne hay, with or without grain supplement, ate a little more hay per day and made more rapid gains in live weight when given early-cut lucerne hay than with late-cut lucerne hay. Given equal weights of hay, the earlier cut produced the best results. In the case of the second and third cut the proportion was as 100 : 85 : 75. The amount of hay consumed per head and per day was about the same, whether the hay was cut early or late, although rather larger quantities of the former were eaten than of the latter. The amount of dry matter and digestible matter required to produce a certain increase in live weight was, however, decidedly less in the case of the early crop, and more in that of the late crop. The proportion for the three cuts was as 100 : 131 : 166.

Fallow Competitions.

NARROMINE AND FORBES, 1922–23.

*H. BARTLETT, Senior Agricultural Instructor.

THE suitability of a district for closer settlement is dependent upon the average production per acre, and although production may be low on partially improved country when thorough cultural methods are neglected, it is quite possible with the aid of science, common-sense, and practice, so to raise the standard of production that a district may be lifted from a purely grazing area to one eminently suitable for closer settlement.

The transition of the western country, more especially portions of the Central-western Slopes and Plains, from virgin land to grazing holdings, then to wheat farms, has been gradual, though of late years a speeding up in the subdivision of the large holdings for wheat farms has been observed, with a continued contraction of the acreage considered to be a living area. But reduction of the living area and increase in production per acre must go hand-in-hand, and although small areas are certainly an incentive to increased production per acre there is involved an increased efficiency in farm practice if a steady yearly income is to be ensured. With large holdings mainly devoted to grazing, and with wheat more or less grown as a side-line, with methods somewhat lacking in efficiency, the experience has been that one good crop will more than counterbalance two lean ones; but with areas of from 500 to 1,000 acres, a payable crop is required every year if the farmer is to keep clear of financial difficulties.

The living areas into which the large holdings of the western district have been subdivided may generally be considered of suitable size, provided the settlers are willing and able to adopt the recommendations which are known to be necessary, plus improvements which experience of local conditions has suggested. So far the difficulty has been for the smaller holder to obtain the necessary instruction in the ways and means of producing better and more reliable returns by which to make himself more independent of the vagaries of climatic conditions, and of crop diseases and pests. Verbal instruction will considerably help a farmer, but it is a far greater asset to him to receive practical lessons from a successful neighbour who has more efficiently farmed his property, thus forcibly driving home the lesson of what can be done.

* With the permission of the Minister for Agriculture the services of Mr. Bartlett were made available to these Associations in the capacity of judge.

The agricultural associations of the western district, recognising the value of friendly rivalry as an educative factor, have promoted growing crop and fallow competitions, bringing to the fore such principles as the value of fallowing, pure seed, control of diseases, weeds, &c. Prior to 1920 the Narromine Association had conducted a number of fallowing demonstration areas worked under the supervision of an officer of the Department of Agriculture, which scheme has merged into a fallowing competition—apparently an ideal method of advancing the application of this important principle. Other associations are now carrying on similar work with gratifying results The work of the Narromine Association has not only had the effect of increasing the area of fallow, but marked results have been obtained in increasing the efficiency of its working.

Success for the small wheat man depends upon the standard of his fallows, and as the soil and districts vary, so will change the cultural operations which are necessary to produce an ideal fallow.

THE NARROMINE COMPETITION.

Although the Narromine Association has been conducting fallowing propaganda for the past four years this is its initial effort in promoting a fallowing competition. Prizes aggregating £15, in the sums of £10, £3, and £2, were offered for the best blocks of 100 acres of fallow, to be judged in March, under the following scale of points: *

Moisture	30 points.
Mulch	30 ,,
Weeds	30 ,,
Consolidation	30 ,,
Cultivation	30 ,,
Total	150 points.

For this competition a total of fourteen blocks were entered by ten competitors, and judging took place from the 19th to 21st March.

The rainfall registered at the Narromine Post Office during the fallowing period was among the lowest on record :—

1922.		1923.	
July	219 points.	January .	28 points.
August ..	87 ,,	February ...	Nil.
September ...	84 ,,	March 19th ..	18 ,,
October ...	75 ,,		
November ...	Nil.	Total ..	829 points.
December ...	318 ,,		

Many parts of the district received even a lighter rainfall, one portion registering only 340 points during the nine months.

* Explanatory notes of this scale of points were published in the *Agricultural Gazette*, October, 1922, p. 716.

DETAILS OF AWARDS.

Competitor.	Moisture.	Mulch.	Weeds.	Consolidation.	Cultivation.	Total.
Maximum Points	30	30	30	30	30	150
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
1. Gibson, P.	20	28	28	27	29	132
2. Crawford, E. R. (Block B) ...	17	27	30	27	26	127
3. Griffiths, R (Block B) ...	20	25	29	25	25	124
4. Crawford, E. R. (Block C) ...	17	25	30	26	24	122
5. Crawford, E. R. (Block D) .	17	25	26	25	27	120
6. Crawford, E. R. (Block A) ...	20	27	28	10	29	114
7. Griffiths, R. (Block -) ...	25	25	29	10	23	112
8. Kilby, D.	15	27	30	10	28	110
9. Gainsford, W.	15	25	29	10	26	105
10. Gainsford, K.	15	25	28	10	25	103
11. Oates, E. C.	17	25	29	10	20	101
12. Griffiths, H. H.	15	25	30	10	18	98
13. Gardiner, H. J.	15	25	28	10	16	94
14. O'Neil, B.	15	20	29	10	15	89

The Leading Fallows.

Mr. P. Gibson, "Compton."—Presented almost an ideal fallow for inspection. Rainfall totalled 883 points, being practically the same as that of Narromine, excepting for a fall of 60 points on 12th March, when Narromine registered 6 points. Special credit is due for the evenness and thoroughness of all cultivations, especially at the corners and finishes, which conformed to the remainder of the paddock. The mulch had a depth of 2½ inches, even, and of the right texture, and the sub-surface soil was fine and nicely compacted. A few stray melons caused a loss of 2 points.

The paddock is of a clayey loam, of the river type of country, and has not been under cultivation for fifteen years. It was disc-ploughed to a depth of 4½ inches in July, 1922; harrowed 15th October, rolled 20th October, spring-tooth cultivated 10th December, and 14th March. Sheep were run on the fallow during the following periods:—1st to 15th February, 650; 15th to 28th February, 750; 1st to 7th March, 300.

The paddock was cultivated four times after ploughing, the last two being immediately following useful rains. The land was rolled during October—a practice which is not usual in this district—but as the paddock had been under grazing for such a long period, and is of a heavy nature, it ploughed in a very lumpy condition, and the rolling was necessary to break the lumps and prevent them caking with the summer heat. Undoubtedly the rolling, grazing with sheep, and the cultivations immediately after rain were responsible for the nicely compacted sub-surface soil. The moisture content in the subsoil was good.

E. R. Crawford, "Edendale."—Mr. Crawford is a returned soldier, who has been on his farm of 920 acres for the past three years. This year he

will be sowing 580 acres of fallowed land, and will be fallowing 360 acres for next year's crop. He submitted four blocks of 100 acres each for inspection, all bearing evidence of careful working and a sound knowledge of the principles of fallowing. His best fallow was of reddish-grey loam, 1 foot deep, overlaying a red clay, slightly gravelly subsoil. The mulch was in good order, the consolidation good, weeds nil, cultivation slightly faulty at corners and finishes. The moisture content of the subsoil, though low, was comparatively good considering the exceptionally dry period, only 340 points being registered during the nine months.

The paddock was ploughed 5 to 6 in. deep, June and July, 1921, and a crop was sown immediately. It was ploughed 4 inches deep in January, 1922, with a disc and a mouldboard plough. Sown with wheat in May. The crop failed to germinate, and the area was spring-tooth cultivated in July, harrowed in September, and spring-tooth cultivated in December.

This area actually had a fourteen months' fallow.

R. Griffiths, "*Kabinga*."—Mr. Griffiths submitted for inspection two blocks, which were rather remarkable for their moisture content and the nearness of the moisture to the surface. The paddocks are situated at the foot of granite hills, and are of a sandy loam granitic formation 18 inches in depth, overlying a rather cold, more or less impervious, grey to red clayey subsoil

The rainfall for the period was 10·80 points, 554 points of which fell last December; this fall, coupled with the timely cultivation in January, was responsible for the good moisture content.

Block A, which is nearest the hills, is subject to washaways, making even and uniform cultivation difficult. It was also lacking in consolidation, which admittedly is difficult to obtain on this type of country. Block B is more even in type and fairly level. The mulch was of good type though varying slightly in depth. Consolidation was good. The corners and finishes were exceptionally well covered, but the ploughing had varied somewhat in depth. The moisture content was not as high as in Block A, no doubt owing to a more porous subsoil. Block B was mouldboard ploughed in July, 1922, spring-tooth cultivated early in October, and in January, 1923. The block was grazed with sheep when necessary. The cultivations of Block A were the same, but following on those of Block B.

The working of this type of country is very different to the working of the heavier red soils, which are most common in the district. The use of disc implements would be disastrous in destroying granular formation, and Mr. Griffiths confines his cultural implements to the mouldboard plough and spring-tooth cultivators. Implements are never worked when dust will rise. Usually a 4-inch ploughing in July, and two cultivations, plus the tramping of stock, will produce a good fallow. This does not apply to the heavier soils of the district, where disc implements are often necessary, and as many as five or six cultivations would prove profitable.

Remarks.

The balance of the blocks were all worthy of being entered in such a competition. They failed in certain respects, but examination of the award table will enable the competitors to eliminate the defects prior to the next competition.

The most common fault was lack of consolidation, but this must be largely attributed to the droughty conditions. In a few cases the ploughing had been too shallow, and subsequent cultivations had reached the ploughing depth. All the fallows were remarkably clean. In one case the spring-tooth cultivator had not been used, allowing clods to remain buried, making the soil too open.

FORBES COMPETITION.

This was the initial effort of the Forbes P.A. and H. Association in promoting a fallow competition, and prizes aggregating £6, in the sums of £5 and £1, were offered for the best blocks of 50 acres of fallow.

It is regrettable that only three entries were received, and it is not very encouraging to the association, which went to the expense and trouble of promoting the competition wholly in the farmers' interests. It may be that the competition was not given sufficient publicity, but it seems that the small number of entries was due to a misunderstanding as to the method of judging the fallows, many assuming that lack of moisture would exclude a fallow from all possibility of winning a place. Admittedly the fallowing period had been dry, but moisture content is allotted only 20 per cent. of the total points, and all farmers have been working under the same difficulties. It is to be hoped that farmers will realise the advantages of the fallow competition as an educative factor, and will give greater support to the association for the 1924 contest.

The rainfall during the fallowing period, July, 1922, to March, 1923, was as follows:—

1922.	Points.	1923.	Points.
July	223	January	38
August	139	February	Nil.
September	72	March	14
October	93		——
November	Nil.	Total ...	790
December	211		

Details of Awards.

Competitor	Moisture.	Mulch.	Weeds.	Consolidation.	Cultivation.	Total.
Maximum Points ..	30	30	30	30	30	150
	Points.	Points.	Points.	Points.	Points.	Points.
Miller, D. N. L. ...	15	22	29	27	25	118
Clements, W. ...	15	25	27	26	23	116
Jones, T. R.	15	23	29	15	27	109

The Fallows.

Mr. D. N. L. Miller, "Glenlossie," Tichborne.—An undulating paddock of chocolate, clayey loam overlying a clayey, gravelly subsoil on the rises, and a deeper loamy drift soil in the hollows. The mulch was rather too compact; consolidation good, weeds almost nil, cultivation slightly uneven.

Sheep had the run of the paddock throughout the fallowing period. The paddock has grown eight crops in twelve years, and was under wheat in 1921. It was mouldboard ploughed 4 inches in June–July, 1922, harrowed August, spring-tooth cultivated September, harrowed 8th March.

Mr. W. Clements, Glenisla, Forbes.—A paddock of 50 acres on rising ground, the soil varying from light to heavy red loam. The mulch was in good order, consolidation slightly uneven. A few scattered melons caused loss of three points. Sheep had the run of the fallow during February and March.

The paddock has grown six crops in eight years, the last crop being wheat, in 1921. Disc-ploughed June and July, 1922; disc-cultivated October, harrowed March. The rainfall totalled 562 points for the nine months.

Mr. T. R. Jones, "Birdwood," Forbes.—This paddock varied from light to fairly heavy red loam, and has been under cultivation for twenty-five years, the last crop being wheat, in 1921. The stubble was lightly disced in February, 1922, ploughed 4 inches in August, harrowed December, disc-cultivated February, 1923. The mulch was rather fine and deep; the sub-surface soil was rather too loose and varied in thickness. The diagonals and corners were well cultivated.

State Conference of the Agricultural Bureau.

Arrangements for the programme for the State Conference of Branches of the Agricultural Bureau, to be held at Hawkesbury Agricultural College from 18th to 22nd June, are being steadily advanced. The main lines of the programme have already been published, providing for the first day in Sydney visiting different places of interest, the opening of the Conference at the College on the following day, and the free parliament for the discussion of the motions submitted, with the debate on rural finance, occupying two or three days, the whole concluding on the Friday.

In addition to officers of the Department of Agriculture, the following have indicated their intention to be present, viz.:—The Minister for Agriculture; Minister for Lands; Chief Railway Commissioner; Chief Commissioner, Government Savings Bank; Under Secretary, Department of Agriculture; Under Secretary, Department of Education; Professor Watt, Sydney University; Mr. Kelly, Chairman, Advisory Board, South Australia; Chief Inspector, Department of Agriculture. Officers of quite a number of Departments will also attend in connection with matters affecting their own Departments.

An early list of motions to be submitted by branches will greatly facilitate classification and arrangement of the agenda paper, and Secretaries are asked to forward the submissions of their branches as early as possible, in order that the business paper may be forwarded to each branch to enable delegates to be properly instructed on the subjects to be discussed.

Can the Wheat Yield of the Central-west be Doubled?*

W. W. WATSON, Tichborne, Parkes.

THE question "Can the wheat yield of our district be doubled?" would be brushed aside without any thought by many of our growers, and the suggestion pronounced impossible. Impossible, because their average yield over fifteen or twenty years has been 10 or 11 bushels, and they cannot see any method or reason for an increased yield. There appears to be a very big proportion of farmers who cling very tenaciously to the idea that the methods of twenty years ago are good enough for to-day, and hedging them around is the perpetual disinclination to adopt new methods, even when in many cases the change must mean improved yields and necessarily better monetary returns.

But, with the increasing capital value of land and increasing costs in many other ways that appear to be inevitable with the growing tendency to advanced production costs, there are only two ways by which the farmers' margin of profit may be increased, and these are, first by reducing the costs, and second by improving the yields. To-day, with the excessive cost of farm implements, and the high prices of repairs, upkeep and machinery duplicates, there appears little hope of any substantial reduction from any of these sources, and, in the increasing difficulty of profitable wheatgrowing, the farmers who hold to the old methods will find their margin of profit becoming finer and finer, while their more discerning neighbours get better returns as years pass. There is evidence, however, that the move to better methods in wheatgrowing is becoming a factor that will assert itself and show most emphatically that our district is capable of growing much more than a paltry average of 11½ bushels to the acre.

It will be my object in this paper to show how yields can not only be increased, but increased 100 per cent, and for this purpose I will take an ordinary farm of 640 acres of average quality land and with weather conditions typical of our own district. In the Parkes P. A. and H. Association's crop competition, I noticed that of the fifteen competitors, only three owned properties under 1,000 acres. Would it not be a great advantage to the district if more men owning small areas could be induced to compete? But no doubt the small landowner considers he has little chance against the owner of larger areas, owing to the latter having the advantage, apparently, of a chance to rest the wheatgrowing portion of his holding every few years, and also a better chance of overcoming weeds and disease. But the man with 640 acres must cultivate on different lines to get the best results from his land.

* Paper read at the conference of western branches of the Agricultural Bureau held at Parkes on 11th, 12th, and 13th April.

Judicious Cultivation an Essential.

It has been considered by many, good policy to allow land after it has been cropped a few years, to rest, by grazing the area. While this may be practised on larger holdings, the farmer with 640 acres can never make a success of wheatgrowing by adopting such a policy. In fact, I will go much further, and maintain that land, even with our rainfall, should never go out of cultivation. By that I do not mean that it should always be growing a crop, but that it should be in continuous cultivation. You practical farmers have probably noticed how a fire break ploughed round a wheat paddock will show to great advantage the following year, or even to (in some cases) the second year, in the crop grown. Continuous cultivation conserves moisture and helps to liberate the chemicals in the soil and place them in an available form for the succeeding crop. The lands of the older countries in the world have been cultivated for hundreds of years, and where the needs of the soil have been supplied, are now as productive as ever. The lesson of judicious cultivation is the first essential thing a farmer must learn. Without it there is no true progress, and he must end, if not in failure, then in stagnation, and the old lesson will be brought home to him, that "a thing worth doing is worth doing well."

A farmer with 640 acres could fallow and sow from 200 to 250 acres every year in paddocks of not more than 60 acres in area. Small paddocks mean efficient working. As soon as the harvest is over, the stubble, if not cut and stacked, should be burned and the land cultivated or disced, and after the first good rain the area should be sown with oats or some other suitable crop for feed during the autumn and winter. Then the land should be fallowed, or half the area should be treated this way and the balance summer fallowed. By summer fallow I mean plowing during February, March or April for the next sowing in twelve to fifteen months' time.

The excellent advice given by the Department of Agriculture is fully borne out by the results of the local and Royal agricultural societies' crop competitions, and the prizetaker, Mr. Milgate, shows his practical knowledge of crop rotation and efficient cultivation when he admits that the two previous crops grown on the competition area were crops of oats. By this system he gained full points for freedom from disease and only lost one point for cleanliness.

It is an easy matter to find new methods and ideas that prove a success, compared with the difficulty of inducing the average farmer to adopt them. He is always willing to take a risk, and never forgets that ten or fifteen years ago he sowed in July and harvested a 24-bushel crop, or cultivated the stubble paddocks and gathered a 7-bag average. But he does not tell how many years he has not even received his seed in return for twelve months work, and has good reason for knowing what the letters R. I. B. mean. One would think some farmers are only wheatgrowing for a pastime, and not as a business, and until it is realised that the growing of wheat is a business, there can be little improvement in yields. The idea of such farmers is to sow as many acres as possible, and such a practice must be at the sacrifice of good wheat averages.

Three Problems to be Solved.

The wheatgrower in a district such as ours is continually up against three things: 1, wild oats and weeds; 2, diseases; and 3, weather. The wild oats are the most difficult to control and the farmer has constantly to be working to keep them under; but unfortunately on many farms the oats have control and always will until these men learn the habits of the pest. It has often been said that if farmers were to adopt fallowing they would have no difficulty in controlling oats. After thirty years' experience of wild oats and fallow I unhesitatingly say that the ordinary winter fallow will never overcome this pest, and will even, with the recurrence of dry years, increase it. The idea is to cultivate before fallowing as well as after, for we must remember that wild oats will not grow in any quantity under favourable conditions until May, and not even then unless they have some earth covering. By a system of crop rotation these oats are all germinated by the first autumn rains, owing to previous cultivation, and only by this method can the pest be subdued.

Disease, too, must not be overlooked; the toll that flag smut and foot rot take from our wheat fields is enormous, and is increasing. While these two diseases are not yet fully understood, it is generally considered that crop rotation will tend to lessen the trouble. Bunt can be kept within bounds by ordinary methods of pickling seed, as is well known.

The third difficulty is the weather, and this is much easier to control than the other two, as I will strive to show later on.

Good seed is essential to good crops, and the old principle of nature, "like produces like," holds good with wheat as with all else. Pure graded seed will always more than pay for itself, other conditions being equal, and with supplies of pure seed obtainable from our Government farms and other approved growers, there is no reason for any person to sow scrub seed.

The Example of Victorian Farmers.

We have read and heard much about the success of the Victorian (Wimmera) farmers, and how they raised their wheat yields from 7 to 19 bushels per acre in twenty-five years on an average rainfall of between 16 and 17 inches per year; and how the county of Borung in 1921 (the last year for which I could obtain reliable records) harvested an average of 28 bushels per acre from 359,000 acres, while the State average for that year was 16·8 bushels. These men have a thorough knowledge of their soil's needs, and a grasp of the whole subject of wheatgrowing,—maintaining the soil's fertility by summer fallow, crop rotation, cultivation and manuring, and the best varieties of wheat suited to their district and climate. The farmers of the Goulburn Valley, with which I am much more familiar, are now waking up to the fact that there is plenty of room for improved yields, and interest is growing in the methods of their western brethren.

Our Potential Yield.

Now if the Wimmera farmers can produce from 20 to 40 bushel averages, the Goulburn Valley men should not be far behind, and our place should be considerably higher than it is to-day. Our soil is capable of much better results, as most will admit, and our rainfall, while it may be a little erratic at times, is ample to lift our yields far beyond what they are now. While the Wimmera farmers are to be congratulated upon their excellent returns, we have had in our own district, yields which show us the possibilities of wheatgrowing on our Central-western Slopes. Let me refer again to the crop competition of last year. Our district average was approximately 8·6 bushels, and this does not include the area fed off. The average yield of the fifteen plots in the competition was in the vicinity of 22 bushels and some obtained up to 30 bushels. The competitors were scattered all round the district and no crop was fortunate enough to get the usual rainfall, the average for all the crops during the growing period being 7½ inches, compared with the district average of 11 inches. If such a commendable record can be established over our district in a year of scanty rainfall, what might be the yields when we are fortunate enough to receive our average rainfall and above?

The average yield per acre for the whole of the State for the past twenty years is 11¼ bushels, but taking it in five-year periods from 1903, our yield has fallen considerably. The average production in the last five years was only 9½ bushels per acre compared with 12¼ for the first period (1903-08). Surely there is something seriously wrong with the wheatgrowers of to-day. We have better implements now than we ever had, our wheat varieties are much superior to what they were twenty years ago, our manures have as good, if not a better manurial value than then. Where then does the deficiency lie? Surely it must be in the methods of cultivation, and the sooner wheatgrowers realise this the sooner will our State yields improve.

If the farmer with 640 acres, who usually sows about 300 acres per year, were to adopt the best system in wheatgrowing, sow varieties of pure graded seed, suited to his land, and manure judiciously, putting in about 200 acres, I am confident that after providing enough hay for his own use and storing a little for future needs or for sale, he would in a period of ten years sell from his farm an average of 1,000 bags per year, or 10,000 in ten years. This would be a return of 21 bushels per acre from 150 acres. I know the figures appear to be big: I also know that the whole suggestion will be ridiculed by many, especially by men with small areas, but I base my figures not on supposition or probability, but on absolute possibility. Why could not 21 bushels be produced last year when our competition crops averaged 22 bushels? I could mention men who, during the last three years, have averaged 23 bushels per acre, with last year's rainfall considerably below normal, and also one who for the past six years has averaged 22 bushels. Three of those years were under the average rainfall and one, 1919, had only

6¾ inches to its credit. Yet another man I know who has averaged 21 bushels for seven years, in four of which the rainfall was below the usual. On these figures where is the impossibility of a 22 bushel average?

There is one serious objection that some may have to the possibility of attaining these higher yields, which I would like to specially mention: that is, they think it impossible to get all the wheat sown just in a week or two in May. But to-day, with our bigger implements, our late and early-maturing varieties (for which we farmers are indebted to the wheat-breeders of the past and present, and which have given us a longer sowing season than we had even ten years ago) 200 acres is not an impossible task for the farmer to sow, as the whole area could be seeded in less than a month. The plant required need only be of moderate size, as the work is distributed evenly throughout the year and, except for a few weeks at sowing and harvesting time, is only one man's work.

The best returns can only be obtained by the help of sheep and on 640 acres, 200 at least could be grazed for the year, and at times many more. Sheep check weeds, save work, firm the fallow land, eat back rank growths of wheat and oats, and last but not least, help to reduce the bank's overdraft.

I might also mention the effect an increased wheat yield has on a district. It would stimulate land values, improve social life, improve business in our towns, overcome much of the drudgery of farm life, provide some of the smaller luxuries of modern times, and improve conditions and surroundings generally.

In conclusion I would emphasise the need for better farm management, for a better system of cultivation and conservation of soil moisture, a closer grip of the needs and requirements of our wheat lands, and then in answer to my question, "Can our district wheat yield be doubled?" I would answer emphatically, "Yes."

Thirty Years' Experiments with Rotation, Manure and Fertilisers.

In Bulletin No. 182, Missouri Agricultural Experiment Station, M. F. Miller and R. R. Hudelson discuss the effects of crop rotation and continuous cropping upon unmanured and manured soil respectively as evidenced in experiments extending over a period of thirty years (1880-1918). The data reported include results of experiments with different systems of crops, manures and fertilisers, designed to ascertain not only the effects upon crop yields but also upon the soil. This long series of experiments proved that, in general, crop rotation gives better results than continuous crops. Among the rotations used a four-year rotation of maize, oats, wheat, and clover gave somewhat better results than the others. It was shown that in order to obtain good crops the soil must also be manured. As a rule, farmyard manure and chemical fertilisers proved of about the same value from the point of view of crop yield, but farmyard manure was more effective in maintaining the fertility of the soil.

Field Experiments with Wheat.

WAGGA EXPERIMENT FARM.

G. NICHOLSON, Experimentalist.

THE season 1922 could not be regarded as a good average one for the Riverina. Droughty conditions prevailed for the first three months of the year, only 189 points being registered, and the fallows suffered accordingly. For the fallowing period, July 1921 to May 1922, 14·33 inches fell on the fallow. The rainfall for the growing period was as follows:—

	Points.		Points.
May	Nil.	October	108
June	80	November	Nil.
July	330		
August	184	Total	846
September	144		

These 846 points were spread over thirty-three days. The registrations show that the season was short, effective rains not falling until the last week in April and finishing early in October.

Ideal conditions for the growth of black oats and Cape weed prevailed, the late autumn rains coupled with mild temperatures favouring their germination late in the sowing season, and dry conditions early in the season retarding germination until early in May. The plots were not affected to any great extent by disease. Flag smut was the most prevalent in the wheat; some barleys suffered from loose smut -bunt and rust were practically absent.

Cultivation.

The experiments were situated in Paddock No. 1 running under a triennial rotation consisting of (1) fallow, (2) wheat, and (3) barley, fed off or cut for ensilage. The soil is of a uniform red loam of granitic origin overlying a stiff subsoil. During July, 1921, the land was ploughed, turning up in good condition, and harrowed ten days later. A springtooth cultivation was given on 30th August, followed by the disc on 3rd and 5th October, sheep being turned in when necessary to eat off any weed growth. The land was again cultivated with the springtooth on 29th March, and a final cultivation was given on 17th May and a harrowing on the 22nd just prior to sowing

VARIETY TRIAL FOR GRAIN.

Seventeen varieties were under trial, namely:—Hard Federation (used as a check), Wandilla, Wagga No. 13, Bald Knob, Sands, Onas, Union, Gallipoli, Waratah, Ghurka, Aussie, Canberra, Gresley, Forelock, Wagga No. 49, Riverina, and Stamina. The plots, having an area of one-tenth acre, were sown on 24th May at the rate of 45lb. per acre with seed that had been previously treated with bluestone and lime; manured with 56lb.

superphosphate per acre. The fallow was in good condition, with sufficient moisture present for good germination. The germination throughout was successful, with the exception of Riverina, Aussie, Canberra, Waratah, these plots being a little on the thin side. Had the germination been normal these varieties would have yielded more favourably. Growth was slow at the commencement, but with the advent of warmer weather the plots commenced to make rapid growth. The last effective rain fell on 2nd October (50 points); dry conditions prevailing until harvest materially checked the growth of straw, produced a slightly pinched sample of grain, and hastened maturity, more particularly of the late varieties. The experiment was harvested with the combined harvester on 5th December.

Notes on Some of the Varieties.

The following notes are arranged in the order in which the varieties matured:—

Ghurka —Suitable for an early grain wheat; being a very early maturer, is a sparse stooler; good quality straw, light brown in colour and of medium length. The ears are brown, erect and tip-awned. The grain is horny, elongated, dark yellow, and has a tendency to shell.

Sands.—An early maturing variety producing a good bulk of grain, but unsuitable for hay owing to its colour. It is a medium stooler, erect, straw light brown in colour, good quality and length; ears erect, dark brown, long tip awns; holds well grain that is of good size and dark yellow colour.

Gresley.—An early dual-purpose variety, which yielded fairly well this season. The straw is of good quality and excellent length, and might well be tried in hay trials.

Riverina.—A promising new variety, suitable for hay or grain, maturing about the same time as Canberra; stools rather poorly. The straw is of good quality and length, and light yellow in colour; ears white, tip-awned and of good size.

Stamina.—This variety has proved very unsatisfactory this year owing to the straw, which is exceptionally coarse and weak, breaking off soon after the appearance of the ear from the shot blade. The ear is large, erect, bald, light brown, and inclined to shell.

Wagga No. 49.—A medium stooler, erect, straw of excellent quality, fine, good length, and retains its colour well. The ear is of medium size, tapering, white, tip-awned, and shells fairly easily. This variety promises well as a good early hay wheat, maturing about five days later than Firbank.

Aussie.—Matures a few days earlier than Hard Federation, is a medium stooler, semi-erect, white short straw and of good quality; the ears are white, drooping slightly, bald and tapering. The grain is yellow, and of average size.

Bald Knob.—Matures the same time as Aussie, stools well; straw white, of medium length, and good quality. The ears are pale, brown, squarish, with poorly filled tips; does not shell.

Wagga No. 13.—Matures a few days earlier than Hard Federation, is a fair stooler, and erect. The straw is white, of medium length, fine, and of excellent quality. The ear is erect, white, awnless, and holds its grain very tightly. This variety should prove a good midseason dual-purpose wheat.

Waratah.—About the same season as Hard Federation; stools fairly well. The straw is of good length, light brown, and of good quality. The ears are brown, tip-bearded, full and tapering, not inclined to shell. A thin germination militated against a good yield from this variety.

Wandilla.—The most outstanding of recent varieties, having returned the best results in the two years of its trials. It is a variety evolved by the crossing of Federation and Yandilla King; matures a few days later than Hard Federation, is a good stooler, semi-procumbent in the early stages of its growth. The straw is of good length and quality, white and fine. The ear is tip-awned, drooping, white and tapering; holds the grain well.

Union.—Matures about the same season as Wandilla, stools well, erect, light brown straw and inclined to weakness. Ears are erect, brown and awnless; grain light yellow, small and does not shell.

Onas.—Late maturing variety, stools well; the straw is short white and has a tendency to weakness. Ears white, erect, and well filled, and does not shell.

Gallipoli.—Late maturer, stools well; the straw is short and pale brown in colour. Ears are erect, compact, and club headed and dark brown.

Forelock.—A heavily-bearded late maturing wheat. The straw is of medium length, light brown and fair quality. Ears are white, tapering, and heavily-bearded.

Variety.	Acre Yield.		Variety.	Acre Yield.	
	bus.	lb.			
Wandilla	31	[illegible]	Ghurka	23	21
Wagga No. 13	28	8	Aussie ..	23	19
Bald Knob	27	58	Canberra	22	58
Sands	27	38	Gresley	[illegible]	[illegible]
Onas ..	27	12	Forelock..	21	45
Union	26	38	Wagga No 49	21	14
Gallipoli ...	24	21	Riverina ..	21	3
Waratah	23	54	Stamina	20	0
Hard Federation	[illegible]	[illegible]			

VARIETY TRIAL FOR HAY.

With a view to ascertaining the most suitable early and midseason variety of wheat to grow for hay, the following varieties were tested this year:—Firbank (used as a check), Improved Steinwedel, Riverina, Aussie, and Union. The plots were each one-tenth of an acre in area, sown on 25th May, at the rate of 57 lb. of seed previously treated with bluestone and lime for the prevention of bunt, and manured with 56 lb. of superphosphate per acre Only a fair germination resulted. Firbank (check No. 1) and Riverina did not germinate as well as could be desired. The plots made

fair headway and were not affected by late frosts. With the exception of a little loose smut in the Firbank, the plots were free from disease The plots were cut with the reaper and binder on 31st October.

Firbank is a standard early hay wheat for this district, and over a number of years has proved superior to most varieties, both as regards yield and quality.

The results favour *Improved Steinwedel*, which gave the heaviest yield, but it is as well to note that this variety is a profuse stooler, while in the case of Firbank stooling is poor, and the rate of seeding for best results is 70lb. Improved Steinwedel, although being a good early hay variety, has a straw which is not of the best quality, weighs light compared with its bulk, and has a tendency to weakness.

Riverina promises well as an early hay wheat, and has the advantage of yielding a fair sample of grain.

Aussie, although a fair dual-purpose variety, can hardly be classed as a good hay wheat, its main disadvantage being the shortness of straw ; stooling, colour, and quality of straw are excellent.

Union is too late a maturer for late sowings, and although an excellent stooler, it only produces a short length of straw, which is not of first class colour, and is inclined to weakness.

Variety	Yield per acre based on percentage			
	t.	c.	q.	lb.
Improved Steinwedel	2	7	1	15
Riverina	2	0	0	0
Firbank	1	15	0	0
Aussie ...	1	11	0	20
Union	1	7	1	1

NOTE.—The early sown variety trials were fed off and ploughed in owing to the prevalence of Cape weed. A very dry autumn had rendered it impossible to germinate weed seeds and then to cleanse the land by cultivation, and it was later found that Cape weed was so plentiful as to render the results from this sowing valueless.

IT PAYS TO KEEP FARM ACCOUNTS.

THE farmer who keeps complete accounts and valuations is, of course, better informed than his neighbour who keeps an annual valuation only. And, in the same way, the farmer who is accustomed to take an annual valuation is more in touch with his position than his neighbour who relies merely on his pass-book for information.

If complete accounts are kept the farmer knows, not only whether he is richer or poorer at the end of the year than he was at the beginning, but he has a record of every penny received during the year, and of the money spent either in connection with the farm or used for the living expenses of himself and family, or otherwise dealt with.—J. WOOD, C.A., in *Modern Farming*.

Onion Experiments at Dorrigo.

E. S. CLAYTON, Agricultural Instructor.

AN onion experiment was carried out last season on Mr. H. Short's farm at Dorrigo. The trial was conducted on friable, red volcanic loam, typical of the better class Dorrigo soil. A manurial and a variety trial were planted, but the results of the variety trial were not comparable as the stand was interfered with to a great extent by cutworms.

The previous crop grown was onions. The land had been well prepared and was worked into a very fine tilth. The seed was sown on 30th May, in drills 12 inches apart, with a small hand sower, which was set to sow the seed continuously in the row. In the manurial trial drills were run out with a small plough, and the fertiliser dropped by hand.

Hunter River Early Brown Spanish was the variety grown in the manurial trial, and it proved to be a very suitable variety for the district. The crop was kept free from weeds throughout the growing period by hand weeding.

The growth of the onions was retarded by the very severe frosts experienced last winter, and the crop was also attacked in the early stages of growth by cutworms, which reduced the stand. In the later stages of growth grasshoppers caused damage to the foliage, and in some cases even attacked the bulbs. The crop was harvested in December.

RESULT of Manurial Trial.

Fertiliser per acre.	Yield per acre		
	t.	c.	q.
*P9, 4 cwt.	6	18	0
Superphosphate, 5 cwt.	5	15	3
P7, 2¼ cwt.	5	4	2
Superphosphate, 2½ cwt.	4	13	3
M7, 3¼ cwt.	4	7	1
No manure	3	10	2

* P9 mixture consists of superphosphate ten parts, chloride of potash three parts, and sulphate of ammonia three parts. P7 mixture consists of equal parts of superphosphate and bonedust. M7 of superphosphate ten parts, and chloride of potash 3 parts.

The results of this trial clearly indicate the benefit to be derived from the application of fertilisers. The addition of fertilisers increased the yield, and also gave a greater percentage of marketable onions. The plot receiving the mixture P9 at 4 cwt. per acre gave the heaviest yield, and the bulk of the onions from this plot were marketable and of excellent quality. The plot receiving no manure, besides giving the lowest yield, gave the lowest percentage of marketable bulbs; the onions from this plot were small and most of them had to be graded as pickling onions.

Co-operation in Denmark.

C. PEDERSEN, Senior Dairy Instructor.

DENMARK is a little country, her total area (since North Schleswig has been returned to her) being 17,118 square miles, and her population about 3,250,000.

It would be difficult to find a more entrancing subject than the history of Danish agriculture and co-operation from the year 1860 up to the present day. Until the middle of the nineteenth century Danish agriculture consisted essentially of grain production, but in order to get the best results, it was found necessary to combine with it the raising of live stock. It was in working out the combination that Danish agriculture took a line of its own, which gradually led to complete differentiation from other European systems. At this period Denmark exported a large number of live stock to England, but the English farmer had gone in more for meat production, and thereby reduced the demand for live stock from Denmark. This led the Dane to go in for dairy work. Events have shown that it was emphatically the right choice, because dairy farming produces much more food per acre than meat production, while it necessitated those co-operative methods of production and business which have since dominated Danish agriculture.

It is noticeable in the study of Danish co-operation that during the latter half of the last century it aimed mainly at the improvement of methods in the agricultural industries. The peasants formed societies for the purpose of enabling them to adopt means for the improvement of their live stock which they saw practised by large land owners, but which they themselves individually could not afford to employ. They also combined in other societies to improve their business by the manufacture of butter and bacon on a commercial scale, and introduced quite original methods of co operation, such as herd testing societies. Later on they took up the question of improving farm seed, both by producing better strains of different kinds of plants and by making these improved seeds available through co-operative societies. Societies, each with its own single particular object, were formed by the farmers for the purpose of improving farming in the widest sense of the word, and the success achieved was such that gradually farmers in a large way and even wealthy landowners found it to their advantage to become members.

Control by Local Societies.

The local societies form the backbone of the Danish co-operative movement. Sometimes local societies combine and form associations, but the independence of the local societies remains unimpaired. The farmers in almost every village form their own supply store, their own co-operative dairy company, bull club, herd testing, horse breeding or egg-collecting

society as the case may be—all co-operative, but each independent of the others. Members of the committees may belong to several societies, but in all cases they are well acquainted with the objects for which the society has been formed, besides being, of course, trusted and respected members of the local community.

According to the Danish conception of a co-operative society, it is essential that members themselves should manage the affairs of the society; that they should be jointly and severally liable for any loan raised to start it; that they should have one vote each and only one, irrespective of their share in the transactions of the society; that goods should be distributed to or delivered by members at current rates, and that the net surplus, after a substantial contribution to the sinking fund, should be divided among members according to the amount or value of their transactions with the society. Politically and religiously, Danish co-operative societies are strictly neutral, permitting themselves no expressions under these headings.

Co-operation in Denmark has done much to control the distribution of wealth as well as to increase production; it has tended to destroy monopolies and priviliges of all kinds, to reduce poverty, and to make it possible for the people to live in greater comfort. It is unnecessary to stress how vital are such benefits, but, perhaps most important of all, co-operation has ushered in an era in which opportunity is within the reach of everybody. Through the co-operative principle, Denmark has demonstrated that agriculture can be made both a more alluring and a more profitable occupation—more profitable because the amount of wealth that can be taken from the soil may be said to be in proportion to (*a*) the intelligence of the producer, and (*b*) the system under which the produce is distributed. Of these the second is by no means the less important, for however successful the farmer may be in the business of production, if he is exploited by landlord, speculator, or middleman, the calling is bound to be less profitable than it should be, and the industry must inevitably tend to stand still or go back.

For over a generation Denmark has been working out plans for converting the tenant into a home-owner, and with this programme has followed education and the spirit of co-operation that prevails. In relation to culture Denmark is in some ways unique. The State has declared that knowledge shall not be kept in cold storage, but shall be made accessible to the people, for it is realised that its possession is a means to increased production of wealth. Some writers maintain that much of the credit for Danish prosperity must be given to its present system of education.

The system of co-operation in Danish agriculture, in the highly developed form in which we now find it, embraces almost every branch of primary industry, and has its ramifications in practically every parish in Denmark. It has built up an organisation so complete that all the threads converge on one point, from which the joint action of the whole system is in a certain measure controlled. The co-operative movement was not started by a philanthropist, or even by the landlords for the purpose of benefiting their farmer tenants.

It has grown up gradually among the peasants in the villages, and its roots lie in a realisation of the solidarity and the substantial benefits attaching to a system of mutual help.

The Growth of the Movement.

The Danish peasants were from ancient times accustomed to manage in common the affairs of their village communities, and have learned to trust one another and to co-operate in many ways. For example, in the early days, the land was called "common" before it was sold, and anybody could have land provided he would cultivate and work it. Such a person would apply to the local council, which consisted of local men appointed by the community—a body similar to our shire councils. If the applicant did not work it properly he was fined. These local councils also laid down common law, which held good within the village, law breakers being fined or otherwise punished. This old system constituted a sort of co-operation and accustomed the people to working together for the welfare of the village.

The Co-operative Distributive Societies, after several feeble attempts, were formed in 1866 by a clergyman who saw the necessity of improving the material well-being of his poor parishioners before he could hope to gain their attention for spiritual and intellectual teaching. He told the working men about the English co-operative stores of the Rochdale type, explaining the principles of the system, and how sales were made at current prices and for cash, the net surplus being divided among members according to their purchases. From this the movement grew, so that in 1914 there were 1,562 societies in Denmark with 244,000 members.

So far as the working classes are concerned, co-operation is less strong in Denmark than in England, where the workers are better organised. Why, then, did co-operation thrive among the agriculturists of Denmark, and not among those of England? The reasons may be found in the difference between the systems of rural tenure and in the social and educational conditions. In the first place, nearly all agricultural holdings in Denmark are freehold properties worked by the owners, and the average size of the holdings is smaller, being about two-thirds of the average size of holdings in England. Of the Danish agricultural holdings, over 90 per cent. are freehold, while in England the figure is rather less than 13.

The conditions in Denmark in this respect are very much as they were in England in the time of Cromwell. That leader's supporters were the yeoman farmers—the class which in Denmark are the chief supporters and leaders of co-operative agriculture. Ever since the great Danish agricultural reforms at the end of the eighteenth century, the proportion of freehold properties has increased, and by the subdivision of large holdings, the number of holdings, and of late particularly of small holdings, has increased, and the average size of the holdings has consequently decreased.

After the war with Prussia, in 1864, not only did Denmark lose a large part of her land, but she lost all her commerce as well. Her farmers were left in a most pitiful condition, and it was in the process of rehabilitation that co-operation came into its own.

By this time the Royal Agricultural Society of Denmark had commenced to experiment in agricultural problems and dairy work. An instructor to demonstrate and lecture on improved methods was appointed. Young men and young women were taught in the best dairies, and butter-making was improved.

Co-operative Butter and Bacon Factories.

In 1882 the first co-operative butter factory was established, less than 10,000 tons of butter being exported. In 1915, 99,420 tons were exported, the value of which would be about £16,000,000. At that time there were 1,168 co-operative dairy companies and 212 privately owned factories. Of all the milk produced, 86 per cent. was handled by co-operative companies.

The number of cows in Denmark in 1885 was 900,000; in 1915 it was 1,300,000.

Only five years had passed since the building of the first butter factory when in 1887 the first co-operative bacon factory was opened. The promoters had great trouble in raising the necessary capital, but during the first year 23,000 pigs were killed. Up till then the old Danish breed was used. It produced a lot of fat and suited the German market, but not the English, and as England was the better customer it was necessary to discard the old type in favour of one that would produce more lean meat, so the Berkshires and Middle Yorkshires were introduced from England. In 1914 there were 45 co-operative bacon factories killing 2,500,000 pigs; private factories killed 400,000 during the same year.

Poultry Products.

In the middle of the nineteenth century poultry-keeping was very much neglected in Denmark. There was hardly any trade in eggs or poultry, except in the neighbourhood of Copenhagen, and consequently little was produced beyond what was consumed by farmers themselves. The prices were generally "four-a-penny" all the year through, except for a short time during winter, when the price would be 2s. 3d. for a score.

The cheap Danish eggs eventually found favour in England and a trade sprang up. In 1870, 500 score were exported, but 20 years later 5,000,000 score went across the North Sea. With this industry as with others, however, there was little or no profit to the producer so long as he had to sell to a middleman. The first egg-exporting society commenced operations in 1895, and the first chairman, Mr. F. Moller, still holds that position. In 1915 the eggs exported through that society amounted to 4,661 tons. The society has branches all over Denmark, and the value of the eggs exported during the year mentioned amounted to £1,750,000.

In connection with the export trade there are now egg-collecting societies in nearly every village, the object being to collect so often that the eggs can reach the egg exporting branch in time to enable them to be exported and to reach the consumer in a fresh condition. The eggs have to be collected daily by the farmer and stamped with a small rubber stamp bearing the date they are laid.

Dairying.

There are at present 690 herd testing societies in operation. These societies have had an uphill battle, the difficulty being to get suitable men for the purpose. The Government would not help in the matter, so the agricultural schools stepped in to fill up the gap, arranging to give suitable young men one month's course in the work. The result of herd testing is that while in 1887 the yield per cow was only 116 lb. of butter, it is over 300 lb. per cow at the present time.

There are to-day over 900 bull clubs in operation, owning over 1,000 bulls. These are local societies, the object of which is to buy bulls of known and reputed families to mate with the best cows in the herd. The bulls are sometimes exchanged for bulls belonging to other societies.

The co-operative credit system came very late in Denmark, perhaps owing to the fact that many local savings banks filled the need to some extent, and that the commercial banks, as a rule, served co-operative undertakings in a satisfactory manner. Yet, there have been several cases in which co-operators have experienced great difficulties in raising the necessary loans for new societies. Such was the case in starting the first bacon factory and the egg-exporting societies. In 1905 the central co-operative committee sent out invitations with a view to the formation of a co-operative bank. Two of the leading banks in Copenhagen also sent out circulars in which they tried to prove how dangerous it might be to the nation if all banking operations connected with the greatest industry of the country were transferred to one single bank. They asked all banks to join in opposition, and even contemplated approaching the Government in the matter. Nevertheless, in 1909 the co-operative bank started with 236 societies, which signed a guarantee for £37,000. The bank has been a great success, and to-day 732 societies are shareholders, with a capital of £188,000. It has formed many branches in the country, and in 1916 its turnover was £200,000,000.

The foregoing touches in brief some of the ways in which Danish farmers have illustrated the value of co-operation. Denmark embraced co-operation out of stern necessity, and in perhaps no country has the principle of co-operation emerged from the acid test with greater triumph.

Credit as an Essential Productive Process.

Credit has been aptly defined as a means whereby the transfer of wealth from one person to another is effected for a period of time, at the end of which it is restored to its owner. Credit cannot directly increase the actual means of production which are potentially at the service of mankind, but credit machinery can and does transfer from one individual to another the right to use those means, and it is therefore both natural and relatively accurate from the individual point of view to regard credit as an important agent in the productive process.—Report of the Committee appointed by the Government of Great Britain to inquire into the question of Agricultural Credit.

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Blessed Thistle (*Cnicus* (*Carbenia*) *benedictus* L.)

(*Compositae*: Daisy Family).

Botanical Name: *Cnicus*, the Greek name, *Knekos*, meaning *Carthamus* which is derived from the Arabic *qurtom,* to paint, from the orange-red die yielded by *C. tinctorius*, which is largely and widely cultivated in the East; *benedictus*, probably named after St. Benedict

Common Name.—Blessed thistle, Holy thistle, St. Benedict's thistle, Our Lady's thistle, Bitter thistle, Spotted thistle.

Popular Description.—A somewhat stout, erect, branched annual, 1 to 2 feet high or more, slightly woolly. Leaves spiny, 3 to 6 inches long, deeply cut or lobed, pale green, net-veined, often blotched with silver-white markings, toothed and spiny along the margins; the lower ones narrowed into the stem; the upper ones broad and somewhat clasping the stem Flowers yellow, solitary, 1½ to 2 inches broad, surrounded by the upper leaves. Seeds oblong, slightly curved and ridged, with a scar at the base, the top crowned with two rows of bristles; the bristles of the outer row longer and more bristly than those of the inner row.

Botanical Description.—Annual, the heads heterogamous, the flowers equal; heads large, solitary; flowers yellow; outer florets uniseriate, sterile: the central hermaphrodite, fertile; pericline ovoid-globose; bracts imbricate, the outer oval-lanceolate, leafy, longer than the head, appressed, spiny; the inner coriaceous, appressed; appendix spreading, linear, pinnatipartite, spined, with a feeble spine at the apex; receptacle flat, densely setose; leaves pale green, slightly coriaceous, with anastomosing, lighter veins and often blotched with silver-white, upper broad, sessile and decurrent. Achnes oblong, ridged, crowned with a double row of pappus; the inner row of short, fine white hairs; the outer one of stiff yellowish bristles, about twice as long.

Where Found.—Common in southern Europe, Asia, and the Mediterranean region; adventive in North and South America. In 1904 it made its appearance in Australia, and was recorded from North Ovens Shire, Victoria. In December of last year several plants were discovered growing in an oat crop at Forest Hill, near Wagga, by Mr. G. C. Sparks, who stated that it was quite unknown in the locality. Every care was taken to destroy it.

Useful or Otherwise.—It was introduced into Europe from Asia, because of its medicinal properties. In Europe and America it is used as a tonic for loss of appetite, dyspepsia, and intermittent fevers. The leaves and the flowering tops are collected in a young state and carefully dried and pressed, and sold in the drug market at 2d. to 4d. per lb. Like many other thistles it is rejected by stock owing to its bitter taste and more or less prickly nature; and with few enemies to keep it in check it soon spreads and becomes a pest in agricultural and urban areas.

Eradication.—Being annual, the persistent cutting of young plants before they develop seed will keep the weed in check, and eventually suppress it.

Blessed Thistle (*Cnicus (Carduus) benedictus* L.)

Small-fruited Devil's Claw (*Martynia diandra* Glox).

(*Martyniaceæ*: Unicorn plant family.)

Botanical Name.—*Martynia*, named in honour of Dr. Martyn, once Professor of Botany at Cambridge; *diandra*, in reference to the two fertile stamens.

Common Name.—Small-fruited Devil's Claw, Tiger's Claw, Ice Plant, (so named because the lower surface of the leaves are cold on the hottest day), Bichú, Vinchú.

Popular Description.—A rank, coarse herb, 2 to 3 feet high, with more or less fleshy stems and branches. The whole plant is closely covered with small soft glandular hairs, which secrete a watery substance which is cold and unpleasant when applied to the skin. The leaves are large (not unlike small pumpkin leaves), roundish to heart-shaped, on long stalks. Flowers tubular, 1½ to 2½ inches long, usually arranged in short spikes, all drooping. The long tube is whitish, and spotted with red and yellow; the five lobes of the tube are roundish, pale red, with a shining purple spot between each lobe. Seed vessel black, oval to oblong, about 1 inch long and about ½-inch broad, with two short, strong, hooked spines projecting from the top. Seeds oblong, flatish. and dark coloured.

Botanical Description.—Annual herbs with stout erect finely glandular-pubescent stems, 2 to 3 feet high; leaves large, round, cordate, membranous, repand; petioles as long as the leaves; flowers several on short pedicels, nodding, disposed in a thyrse in the forks of the branches; calyx about ½-inch long, with ovate-lanceolate teeth subtended by two large foliaceous bracts; corolla 1½ to 2½ inches long, with a white ventricose tube spotted with yellow and red, and fine round, pale red lobes with a purple spot between the segments; stamens four, two of them fertile; capsule oblique-oblong, rugose, coriaceous, with two incurved sharp beaks, dehiscing longitudinally by two greenish-brown ferrugineo-tomentose valves, seeds one in each cell, oblong, compressed, dark coloured.

Where Found.—It is a native of Mexico, and was introduced into most countries as an ornamental garden plant. As far back as 1731 it was successfully grown in the botanic gardens, Chelsea, England. For over thirty years it has been a frequent weed in Mauritius and the Seychelle Islands. According to Hooker's *Flora of British India* IV, 368, it is common in the Gangetic Plains and elsewhere in India. It is also a common weed in the British West Indian Islands. Bailey, in *Weeds and Poisonous Plants of Queensland*, states that it has established itself in some localities in Queensland, and become a pest. It was first recorded for New South Wales in 1920, when it was received along with two other established species from Warialda.

Useful or Otherwise.—The following extracts are from *Dictionary of Economic Products of India* (Watt). "The Rev. A. Campbell states that the Santals distil a medicinal oil from the fruit; he does not mention the purpose for which the oil is, however, used."

"The fruit is official in the Punjab (Stewart). It is sold in the drug shops as an antidote to scorpion stings, hence the name Bichú (Hind.), and Vinchú, (Mahr.) Its properties are very likely entirely imaginary, being suggested on the theory of signatures from the resemblance of the sharp hooks of the fruit to the sting of the scorpion, the claws of the tiger, &c."

Small-fruited Devil's Claw (*Martynia diandra* Glox.)

It is more or less an attractive flowering plant, suitable for large gardens, but beyond that it is quite useless; and, notwithstanding its wide distribution, it is not mentioned in any available literature to hand, as being useful as a fodder, but it is frequently referred to as "a weed," or "a rank weed." Stock are not likely to take to it owing to its clammy, hairy nature, and unpleasant smell. In fact it is rejected by all classes of grazing animals, and is allowed to spread unmolested, and wherever it takes root it smothers out the better class of herbage by its dense growth.

Its natural distribution is by the hard hooked capsules, which are so adapted that they catch in the feet, tails, and coat of herbivorous animals. In some cases the hard, woody, capsules cause serious injury to sheep and cattle by penetrating the tender portion of the foot.

Eradication.—If the weed can be prevented from seeding its extermination is assured. Hoe, cut, or mattock small patches before the seed is ripe. On cleared grazing areas or cultivated land the ordinary mowing machine can be used with advantage. One or two cuttings during the growing season will have the desired effect. Where practicable the weed should be ploughed under when about half grown, to furnish humus for the next crop.

"Farming Opportunities in South Africa."

Under this title the South African Railways and Harbours Administration has published a volume of 340 pages, which describes the agricultural and pastoral methods and prospects of the Union of South Africa. The work is issued in collaboration with the Union Department of Agriculture, and modern methods, therefore, have their place in this very handy and attractive little work Its chapters are designed to show what are the prospects for the man of enterprise and of moderate capital, quite apart from whether he has had previous farming experience. Maize, sugar, cotton, tobacco, wheat, fodder crops, cattle and sheep, fruit, and so forth are all covered, one chapter or more being devoted to each, so that the immigrant to South Africa will find put into his hands, not only an account of primary production as carried out in the country, but an indication of the methods most likely to be successful.

To the question, "does farming pay well enough to attract the educated man; is there a chance for him in it?" the answer is frank: "There is a chance, but it is a fighting chance. It is not enough to start right. You must continue on sound lines, and that implies a constant battle." In other words good farming is essential to success. But there is nothing forbidding about this. As a matter of fact we are told that "never in the history of farming have there been so many educated and well-to-do people in it. They are revolutionising farm practice, and the living conditions on the farms. For themselves, and for those who follow, they are improving the chances of success."

Much of this is as true of our own conditions as of South Africa, and the compilers of this useful volume can be congratulated on the very sound practical aspect given their literature.

Two Factors in Disease-prevention.

A Note for the Dairy-farmer.

MAX HENRY, M.R.C.V.S., B.V.Sc., Government Veterinary Surgeon, and KEITH HENRY, Farmer, Eastern Dorrigo.

There appeared in the *Agricultural Gazette* for January, three articles, each of interest in its own way, and capable when put together, of carrying a distinct message to the dairy-farmer on the coast and tablelands. We refer to Mr. Downing's article entitled "Field Experiments with Winter Fodders," Mr. Haywood's "Dairying under North Coast Conditions," and Mr Guthrie's "Vitamines." Each of these articles had, if properly interpreted, its bearing on the question of disease-prevention, and it is from that aspect that we considered them; and it appeared to us that it would be desirable to draw attention to two factors which, in our opinion, are of primary importance in maintaining our coast and tableland herds free from disease and preventing mortality amongst them. We refer to the necessity of supplying mineral salts, principally calcium phosphates, and a quantity of actively growing green feed.

The Value of Bone-meal.

Experience on the South Coast amongst cattle affected with osteomalacia—bone-chewing, cripples, &c.—first drew our attention to the benefits to be derived by providing calcium phosphate in the shape of bone-meal to milking cows on lands deficient in these mineral constituents We have since confirmed this on the North Coast in country where osteomalacia did not exist in such a form as to be recognisable clinically, although osteophagia (bone-eating) on the part of the cattle was noted. We have also observed a marked improvement in cows on the central coast, even when fed on a mixture of maize-meal, bran, and oaten chaff, with a little grazing, to follow the regular administration of small doses of bone-meal. Our observations would tend to show that when bone-meal lick is fed in troughs, the liking of the cows for it varies markedly, and those animals which consume it most freely display the best condition and the shiniest coats. (The bully of the herd is apt to answer to this description, and she will keep other cows away out of sheer "cussedness.") The occurrence of osteomalacia in the inland country reported by Mr. W. L. Hindmarsh, M.R.C.V.S., indicates that what we found applicable to the coast will be equally so for some of the inland country, and our experience on the Northern Tableland in administering calcium phosphate to sheep as a lick shows it to have had a markedly beneficial effect on growth.

Not only for its protective and curative action in osteomalacia must bone-meal be regarded as disease-preventing, but it is also the only satisfactory preventive to the mortality resembling lamziekte in South Africa, which has at times appeared in this State. Whether that mortality is a toxaemia due

to the bacillus *botulinus* or not, the whole question of its prevention lies in supplying a sufficiency of calcium phosphate to the cattle. We are convinced that many animals in this State are affected to a slight degree with osteomalacia, with consequent lack of efficiency, although it is not recognised as such, and that the aggregate of loss to the farming community must be considerable. There are on record American experiments indicating that the addition of calcium phosphate to the feed of cows influences the length of the lactation period and the quantity of milk yielded, and even though these results are not universally accepted, they deserve consideration and point to the desirability of similar tests being carried out here on various types of country.

It may be argued that it would be preferable to supply the needed salts in an improved ration, and undoubtedly where lucerne can be cheaply grown and other foodstuffs to complete the necessary ration obtained at a reasonable figure, such a course would be very satisfactory. There are, however, many parts of the State, even in dairying districts, where these desiderata are absent, and instances are numerous where for one reason or another the farmer is not prepared to grow feed in the quantities required. Moreover, there is much country which produces food satisfactory in most regards, but lacking in calcium and phosphates. In all these instances the administration of bone-meal offers an easy and practical method of supplying the deficiency. It is most urgently required in the late winter and early spring, and may be fed in various ways depending on the methods of feeding and milking adopted on the farm.

Where cows are hand-fed the required quantity can be readily mixed in the food of each individual animal, and waste thus prevented. About 2 oz. per day might be regarded as an average dose, but the amount required would vary with the requirements of the cattle, and each case would have to be judged separately. For grazing cattle, the lick may be placed in troughs, preferably with a cover to keep off rain, and the cattle allowed to consume as much as they like. One unfortunate result of this method is that some cows will eat enormous quantities and others hardly any, and although this might be held to indicate the varying requirements of the cows, we are inclined to the opinion that it is to some extent a question of individual liking on the part of the animal. We have noted animals in the pink of condition and without the slightest sign of osteomalacia or other deficiency ailment to eat large quantities for extended periods.

In many instances the cow bails are so constructed that even though hand-feeding is not carried out it would not be difficult to arrange for small boxes containing lick to be placed in front of the cows so that they could obtain their "lick" during milking. In some bails this would not be possible.

Where a lick is available in brick form it may be simply put about the paddocks, in boxes or troughs or otherwise.

We are then of opinion that the supply of calcium phosphate in the shape of bone-meal to dairy cattle would in many parts of the State result in better growth and better milk supply, and the prevention of much disease.

Green Fodder as a Factor in Disease-prevention.

The provision of a small quantity at least of actively growing green food is our second factor. Both Mr. Downing and Mr. Haywood in the articles referred to have emphasised—and rightly so—the value of fodder grown to supply food to the cows in the winter and early spring. Both writers regard the question from the point of view of supplying a complete ration or one complementary to grazing. Undoubtedly, where it is feasible, the procedure they recommend would result in vastly improved farming and a greater milk yield; but actually we find that many farmers are for one reason and another unable to put such an area under crop as would enable them to "feed" their herd. This applies with greatest force to men on country newly opened up. Feeling that he cannot grow sufficient to "feed" his cattle, the farmer is apt to go to the other extreme and grow nothing.

We desire to point out the great benefits which may be looked for by the provision of only a small quantity of actively growing green feed. It is not to be regarded from the point of view of food so much as tonic and disease-preventive.

To illustrate our meaning we will take an actual concrete case.

The farm is a small one, and the land of medium quality in a freshly opened district. The area placed under crop was 2 acres, and the crop chosen was oats. The land had previously been cultivated. It was ploughed, disc cultivated, sown, and again disced, 1¼ bushels of seed being used per acre, and 1 cwt. of superphosphate.

It was sown in July, and, as in August three of the cows appeared to be very low, they were grazed on it every day for fourteen days. At the end of that period recovery was so marked that they were taken off. In October fourteen cows were grazed twice daily on the crop for a week, and in December it was again eaten off by fourteen cows for three days. In all instances the cows are allowed to graze for about half-an-hour only, and were then taken out. The actual work involved per acre was one day's ploughing with two horses in a single-furrow plough, and half a day cultivating. The seed cost 7s. 6d., and the fertiliser 15s. Against that expenditure must be placed the fact that not a single animal was lost on the farm, the life of one was most definitely saved by the crop, and an increased return was obtained, as the yield improved each time the cows were placed on the crop. It may be mentioned that losses of cattle on similar country in the district were very heavy in that season.

Experience has shown us that green oats or green barley are the most suitable crops to grow, barley for early feeding. The first grazing off should be when the crop is about 6 inches high, and should be light. Cattle should not be put on to feed off in wet weather, and the crop should not be grown more than twice running on the same land. The second feeding off is best carried out when the crop is just coming into ear. No doubt waste would be saved if the crop were cut and fed.

Green Feed and Vitamines.

It has been shown that actively-growing green leaves are rich in vitamines, and Mr. Guthrie, in his article, has indicated how important are these substances to the health of man and animal—in fact, they are essential. Now, much of the dry grass, which constitutes almost the sole food of many cows during the late winter and early spring, is certainly lacking in vitamines. It is not yet possible to say to what extent vitamine deficiency is the controlling cause in many diseases of cattle, but the trend of the evidence which is gradually accumulating would show that it is by no means a negligible factor It is not too much to assume that the good results of feeding on small quantities of green oats and barley, and similar crops, are, in part at least, due to the vitamine content of the feed. The quantities eaten would almost preclude them being due to the other food constituents of the plant.

Very small quantities of vitamines are sufficient to maintain health, and it is not necessary—though preferable—that these should be constantly supplied. Doubt is often expressed that the use of such quantities of green food as those to which we refer can be of any real benefit, but experience shows that the value which theoretically they possess is an actuality. We are of opinion that much of the loss which annually occurs in the late winter and early spring, and which is variously referred to as being due to "dry bible," impaction, &c., is at bottom due to want of just such small quantities of green food.

It may be that the two factors to which we ascribe such importance are mutually helpful. They will be found to be linked together if the calcium balance of the cattle is considered. There is no question that in osteomalacia country the excretion of calcium with the milk imposes a heavy strain on the cow, and the amount ingested is not apparently sufficient to balance the loss. Now, the feeding of green oats and other green feed has been shown to have a definite effect on the calcium balance, presumably through increased assimilation. If, however, the ration contains an insufficiency of calcium the benefit to be derived therefrom will not be so marked as it would be if additional calcium were provided in the shape of bone meal.

There appears to exist, therefore, two measures of very considerable value in preventing disease in dairy cattle, and these measures are within the capacity and reach of nearly every farmer. We do not wish to be regarded as advocating them as a panacea for all disease, and we would advocate closer co-operation between the veterinarian and the farmer, firstly, to decide in each individual case of mortality whether such mortality did come within the scope of our suggestions; and, secondly, to endeavour to determine more accurately the basic causes of the heavy annually recurring loss in cattle, a great deal of which, we are convinced, is preventable.

Alpacas and Llamas.

The History of an Attempt to Introduce them into New South Wales.

E. A. ELLIOTT, Sheep and Wool Instructor.

In view of allusions made from time to time to the possibilities of alpacas and llamas being introduced into Australia with advantage, it may be of interest to place on record the facts concerning an experiment of the kind conducted by the Government of this State some seventy years ago.

The impression entertained at that time appears to have been that, as the grazing of sheep was already showing so much promise of becoming a staple industry, there were possibilities also in connection with the alpacas, llamas, &c., which were at that time so highly esteemed in South America. The experiment was a daring one and interesting, but unfortunately it was not successful, and it is not likely to be repeated, but the facts are quite worthy of record in this journal.

The alpaca and the llama are the domesticated varieties of four somewhat closely related species that are native to the high plateau country among the Andes Mountains of South America, the wild forms being the guanaco and the vicuna. The llama is used as a beast of burden and also as food, but it does not grow a profitable fleece, while the alpaca, which attains a height of about 4 feet, grows a coat of long fine hair that hangs in flakes from the breast, side, and rump. When annually shorn alpacas cut a fleece of from 7 to 10 lb., the fibre being strong without being coarse, very uniform over the fleece, bright, elastic, and soft, and possessing a glittering brightness which gives it the appearance of silk. The hair varies in colour from black through various shades of brown to white, the last being, of course, the most valuable. The animal itself is somewhat like a camel, to which, indeed, it is supposed to be related, and, like the camel, it can exist on little or no water, the peculiar formation of the stomach enabling the use of moisture obtained from the vegetable matter for digestion and for the purpose of allaying thirst. Its common food is coarse grass, moss, furse, and tree-tops.

The Introduction from Peru.

In 1851 the British Consul at Lima, Peru, after consultation with a Mr. C. Ledger (a merchant of Peru trading extensively with the Indians of that country) as to the possibilities and expense of exporting alpacas and llamas to the colony of New South Wales, extended the invitation of His Majesty's Government to Mr. Ledger to visit New South Wales in order to ascertain the suitability of its climate and pasture for the successful raising of the animals. The issue was complicated somewhat by the fact that the exportation of alpacas was prohibited by the government of Peru, but as,

after an extended tour of New South Wales, Mr. Ledger was favourably impressed with certain areas for the purpose, he was commissioned by the Government to procure a number of the animals and to bring them to this country. He returned to Peru, and spent five years collecting animals and preparing them for the long sea voyage. During that time he suffered considerable hardship, being imprisoned twice, and eventually having to travel to the coast via Argentine and Chili, but in 1858 he arrived in Sydney with 276 animals—alpacas, llamas, crossbreds, and a few vicunas—and a number of Spanish attendants.

The flock was temporarily located at Liverpool, but as a result of a tour of the State for the purpose of finding the most suitable locality for the animals, the Snowy River country in the Monaro district was chosen by Mr. Ledger. It was, however, decided to locate the flock at Goulburn, and Mr. Ledger, who had been appointed to the position of Superintendent of Alpacas, &c., took them there, occupying two months in the journey.

The alpacas seemed to do well, the frame of the animals bred locally being larger and the general appearance superior to those imported from Peru, but the vicunas proved untameable, and had all died by 1861. By feeding experiments it was ascertained that rough pastures suited the animals better than rich foodstuffs such as lucerne or clovers. The fleece produced under the climatic conditions of this country proved finer and heavier than under the natural Peruvian conditions, cases being on record of a lamb of five months cutting a fleece of 7 lb., and an alpaca with twenty-one months' growth cutting 21 lb. of hair. Scab made its appearance in the flock, and though the advance of the disease was checked by careful handling, it did not seem possible to eradicate it.

A number of unfortunate misunderstandings as to the dealings of the Superintendent with the Government in regard to the handling of the flock and with private societies for whom he was also handling alpacas and llamas, led to his retirement and ultimate return to Peru, and the Government eventually decided to offer the flock for sale at auction. Some difficulty was experienced in obtaining the reserve imposed by the Government, and in the end the animals were given away to various squatters and landowners throughout the colony, but the interest shown in them was never great.

The attempt to introduce these animals into this country at a time when the breeding of Merino sheep was occupying attention so extensively and profitably was probably one of the principal causes of failure, but the alpaca could not very well be expected to compete with the Merino. In the first place it grows a coat of hair, while the wool of the Merino is a much more valuable product. The alpaca being a larger animal, too, and consequently requiring a larger run for the same number of animals, may have been a contributing factor to the preference shown by pastoralists to the Merino. Certain it is that the animals which were distributed to landholders did not receive much attention, for they are not now to be found, and to-day, so far as is known, the zoological gardens in the larger cities are the only places where such animals are to be seen.

Insect Pests of the Cultivated Cotton Plant.

No. 4.—Cutworms and Leaf-eating Beetles.

WALTER W. FROGGATT, F.L.S., Government Entomologist.

In the previous papers the writer has dealt with special groups of cotton insects. In this paper it is proposed to give a brief account of some of the cosmopolitan cutworms and foliage-eating insects that attack many different plants, among them the cotton plant. As the acreage of cotton crops extends over Australia, the food supplies of these insects will be increased, and it is only reasonable to expect that the insects will advance in proportion. Any information that can be tabulated regarding such pests—their mode of development, their general appearance, and methods of control, should therefore be valuable to the present, and to the prospective cotton-grower.

The Maize Moth or Cotton Bollworm (*Chloridea (Heliothris) armigera*).

This is one of the commonest and most widely-distributed noctuid moths, being found not only all over the cultivation paddocks and gardens in Australia, but being also recorded as a field crop pest from all over the world. Like many other cosmopolitan insects, it has been described by entomologists under a number of different scientific names. It is also known under the name of *Heliothris obsoleta*, and Gurney, in his "Insect Pests of Maize," this *Gazette* (Vol. XXX., p. 201, 1919), calls it *Chloridea obsoleta*. I follow Hampson's British Museum Catalogue (Vol. LV., p. 1), taking his generic name, and retaining the original specific name given it by Hubner.

A very interesting account of this cosmopolitan moth was given by Mr. Olliff in the first volume of this journal, 1890 (p. 126). He described it as the common maize moth in New South Wales.

The maize moth caterpillar usually feeds upon the seeds of the food-plant. It cuts its way through the envelope of the maize cob, generally at the apex, and gnaws the top grains and down into the cob. The damage is not confined to the maize it devours, for the rain entering the damaged cob causes the maize to rot. In the same way it gnaws its way through the side of the ripening tomato to eat the seeds. It cuts its way into the pea and bean pods, eating up the enclosed seeds one after the other until it is full-fed; then it crawls out, enters the ground, and pupates in a cavity in the soil. In the summer the perfect moth emerges from the pupal state ready to lay a batch of eggs after a few weeks only.

The adult moth, when at rest with its wings folded, measures about 1 inch in length and has a wing spread of about $1\frac{1}{2}$ inches. It is variable in colour, the fore-wings ranging from light creamy brown to brownish yellow, sometimes fading into olive tints. The head, thorax, and abdomen are clothed

with scales of a similar colour. However variable the rest of the colouration may be, that of the hind-wings is constant and characteristic, the inner portion being silvery grey with an irregular band of black encircling the outer margin.

The slender caterpillars vary from pale green to olive brown, the head light brown, and legs blackish. The reddish brown pupæ are easily found in an infested paddock just beneath the surface of the soil.

In consequence of the damage they do in the cotton fields of the United States, their life history and habits have been carefully investigated by economic entomologists Bishopp states (Farmers' Bulletin No. 290, United States Department of Agriculture, 1907), that in the southern States, from 16 to 20 per cent. of the cotton bolls are damaged by this bollworm. Mally (Report on the Bollworm, Agricultural College, Texas, 1902) says that in the summer months the duration of the pupal stage is only ten days, so that there are several broods in the season, and that 653 eggs have been laid by a single moth in captivity. Under the name of *Heliothris obsoleta,* it was recorded as a cotton pest in Egypt in 1906.

During the last year a number of cotton bolls infested by this caterpillar, which bores a circular hole through the side of the boll have been received by the Department from all parts of the State

The Bugong Moth (*Agrotis ypsilon*).

This is another noctuid moth which has a world-wide range, in the larval stage it is one of the cutworms that damage many different field crops in Australia. It has been described under half a dozen different names. The synonomy will be found in Hampson's Museum Catalogue (Vol. LV. p. 368, 1903)

In Australia it received the popular name of Bugong Moth because every summer it used to swarm in countless millions into the shelters of the overhanging rocks on the Bugong mountains, near Tumut, New South Wales The blacks collected them in their dilly bags, scorched them over a fire, and pounded them up into a mass which they roasted and ate like cake. In some years these moths appear even in the vicinity of Sydney and swarm into the houses at night until they become a regular pest

The moth is a large dark brown insect, measuring about two inches across the outspread wings The head, thorax, and abdomen are thickly clothed with dark brown scales. The fore wings are mottled along the first portion, with heiroglyphics likened to the Greek letter *ypsilon,* from which it takes its rather appropriate specific name The apical portion is mottled with lighter tints. The hind-wings are lighter than the fore wings. These moths on emerging often swarm like bees round the flowering eucalypts in the evening. The eggs are laid on the grass or herbage, and though the caterpillars are very numerous when they first hatch from the eggs, they are not very noticeable until well grown These caterpillars are typical noctuid cutworms, elongate, slender in form, varying from light brown to olive green, and

striped on the back and sides with fine parallel lines. When full-fed they bury themselves under the loose soil and pupate, forming a dark reddish-brown pupal case in a cavity in the earth.

In India this pest is known as an omnivorous feeder, and is common on cotton. It is also destructive to the foliage of the cotton plant in Egypt and the United States.

The Spotted Yellow Maize Moth (*Cognogethes punctiferalis*).

This moth was figured and described in the pages of this journal in 1897 (Vol. VIII, p. 104) It was bred from larvae that were feeding upon the outer surface of clumps of China peaches, which it matted together in web and frass. It is well known in the seed heads of sorghum, and also gnaws into the stems and cobs of maize Mr Gurney figured and described it as a pest of maize in this *Gazette* in 1919 (Vol. XXX, p. 200). Specimens have recently been sent to the Department with cotton bolls from the Tweed River.

The moth is a very distinctive insect of a uniform bright yellow tint, irregularly spotted and marked with reddish brown on both pairs of wings and on the surface of the abdomen.

The Grey-streaked Moth or Egyptian Cotton Worm (*Prodenia littoralis*).

This moth was first bred by the writer in New South Wales in 1896 from caterpillars defoliating an apple tree in his garden at Croydon, and an account of this, with an illustration of its life history, was published in the *Gazette* in the same year (Vol. VII, p. 759) The handsome noctuid moth measures about 1½ inches across the outspread wings The fore-wings are greyish-brown, delicately marbled or streaked with fine silvery lines on the apical half; the hind wings are pearly white. When at rest, with the wings folded on the soil (as when they have just emerged from the pupal shell), their colours blend so well with their surroundings that they very easily escape notice, and this mimetic colouration must be a great protection against birds and other enemies.

The moth lays her eggs in a mass on the under-surface of the foliage, and covers the egg clusters with down from the tip of her abdomen. Willocks, in his account of the damage this moth causes in the cotton fields of Egypt, gives a table of a count of twenty egg masses ranging from 320 to 1,063 eggs. When working out the life history of the moth on the apple tree foliage at Croydon, the writer counted 1,356 eggs in one patch. So the fecundity of this moth when on suitable food is something remarkable.

The slender, dull olive green caterpillars, when full fed, measure about 1½ inches in length, and are lighter coloured on the sides. They are very active. The smaller ones feed at first on the surface of the foliage, but as they develop they devour the whole of the leaf, soon stripping off all the foliage.

Willocks describes this as one of the worst cotton pests in Egypt, often not only stripping off all the foliage over large areas, but even destroying the flowers, squares, and bolls.

This moth has a wide range over Australia. It will probably make its appearance in our cotton fields, when an extra good season comes along with a luxuriant growth of grass and herbage.

The Army Worm (*Cirphis* (*Lucania*) *unipuncta*).

This is another noctuid moth that has a wide range over the world. It was accidentally introduced into Australia at a very early date, and was identified as a field crop pest many years ago. It is a well known pest on the cotton plants, among other field crops, in the United States.

Like the Bugong moth, this insect deposits her eggs upon the grass and herbage along the river flats, and under suitable conditions immense swarms of the slender, dull-green caterpillars appear and devour all before them. In the 1903–4 season, a large area of the wheat belt of the north-west was overrun with hordes of hungry caterpillars. These did an immense amount of damage to the grain crops from Tamworth to Singleton, and many parts of southern Queensland were devastated in a similar manner.

The writer published a short article entitled "The Army Worm (*Lucania unipuncta*, Haw.) in Australia," and illustrated with figures of the moth and its larvæ in this *Gazette* in April, 1904 (Vol. XV., p. 327). The moth measures about 1½ inches across the outspread wings. It is of a uniform silvery grey to buff tint. The fore-wings are delicately spotted with reddish-brown scales, forming indistinct bands round the outer margin; the hind-wings are more silvery than buff, and are unspotted. The full-grown caterpillars are of a dull olive-green tint, striped on the sides with parallel bars of dull brownish-white; they measure about 1¼ inches in length. When full-grown they bury themselves in the soil and pupate just beneath the surface. Most of these cutworms rest during the heat of the day, hiding among the clods, in the cracks of the soil, or under the shelter of the herbage, and emerge about 4 o'clock in the afternoon to feed through the night.

The most successful method of dealing with all cutworms is the use of poisoned bait scattered over their feeding grounds as soon as they appear.

The Red-shouldered Leaf Beetle (*Monolepta rosea*).

This handsome little beetle was described by Blackburn in 1890 (*Proceedings of Linnean Society of New South Wales*, Vol. 5, p. 364). The genus is well represented in Australia by a number of species, several of which have been recorded as pests. This species was first noticed as a leaf-eating pest by Olliff in this *Gazette* in 1892 (Vol. III., p. 699). He called it the Two-spotted Monolepta or Leaf-eating Beetle, describing it as destructive to vegetables and many garden and native plants, and a beetle of which the earlier stages were unknown. In his notes he gives a long list, sent to him by correspondents of plants damaged on the northern rivers by this pest.

Since that date there have been several references to this beetle in the *Gazette* as a pest on different plants, mangoes, oranges, lemons, and the foliage of apricots having been reported as affected. In Vol. XXX., Gurney described and figured it under the popular name of the Yellow Monolepta beetle, giving a list of its food-plants and a record of experiments with liquid and dust sprays at the Grafton Experiment Farm. In regard to the popular name of this beetle, we have quite a number of spotted or yellow leaf beetles, and both yellow and spotted, so the name is rather misleading. I would therefore suggest that the Red-shouldered Leaf beetle or Red-shouldered Monolepta would be much more distinctive.

Monolepta rosea is a small, light-yellow beetle, with black eyes, and with the five apical joints of the antennæ dark brown. The head and thorax are narrow, the thorax rather long, and rounded on the sides. The shoulder or front margin of the wing covers is banded across with deep pink, and with a spot, or sometimes quite a large blotch, of a similar colour in the centre of each wing cover. The legs are long and well adapted for running; and in the warm sunshine the beetles are very active, and fly readily when disturbed on their food-plant.

Though chiefly confined to the northern rivers, from Tweed Heads to Lismore and Grafton, the range of this beetle sometimes extends to the vicinity of Sydney, and even into the western areas. The insects frequently appear in such enormous numbers that in the course of a day or two they will have devoured all the foliage of a fair-sized tree, and when they get into the cotton crops they strip off all the foliage before they leave the plants, and the crop is ruined. In one month recently we had at least a dozen records of the whole or part of the growing cotton plant in paddocks in the north being invaded by these beetles, and of all the cotton plants being defoliated.

Suggestions for Control.—Spraying with a surface poison will kill these beetles, but they have to eat the poisoned foliage before it is effective; where there are countless thousands, therefore, the foliage will be destroyed before the insects are all killed. Dust sprays may have a repellent effect upon the beetles and will also kill them by contact, because the beetles in cleaning their legs and antennæ from the dust will get the poison into their mouths, and are killed by its action. Several growers have been experimenting with a torch flare. This is a rag soaked in kerosene wrapped round a broom handle; it is carried down between the rows of cotton after dark while an assistant stirs and shakes the plants on either side. The swarming beetles fly into the lighted torch and fall scorched to the ground. A naked acetylene lamp or other naked light might be substituted for the torch, as equally effective and more handy.

Another means of control is the use of the "hopper dozzer" or oil pan, a method which was described in these pages last March (p. 170).

The 28-Spotted Ladybird Beetle (*Epilachna 28-punctata*).

This is one of the few plant-eating ladybird beetles. All the others, except the two or three species of this particular genus, live upon aphis, scale, mites and other noxious insects.

This beetle is of the typical ladybird form. It is of a dull orange colour, spotted with more or less regular black dots; though presumably twenty-eight when the spots are large, they are variable both in size and number. The eggs are laid on the foliage of the food-plant in little bundles. The larvæ are of a dirty yellow colour, and are easily identified by the number of closely spined, black, hair-like tubercles covering the dorsal surface. When full-fed, the larva attaches itself by the tip of the tail to the food-plant and undergoes its metamorphosis with the split larval skin hanging above it like an opened coat. Both the larvæ and the adult beetles feed upon the upper surface of the leaves of the infested plant. Until recent years, they confined their attention to the plants belonging to the big group *Solanaciæ*, comprising the tomato, potato, tobacco, and nightshades, and were particularly fond of the foliage of the Queensland trumpet flower weed, *Datura stramonium*. During the last two years, however, they have turned their attention to cucumber, melon and pumpkin foliage, and have become a rival of the true pumpkin beetle pest. They have now been found in the Tamworth district attacking the foliage of the cotton plants.

To Cleanse Muddy Water

Water containing mud in suspension is easily clarified by the addition of certain chemicals that cause the minute particles of silt to collect into larger aggregates that settle to the bottom. These flocculations enclose and carry down with them many micro-organisms, eggs of hydatids, &c., and leave the water bacterially purer.

When cheapness and chemical efficiency are considered, the chemicals suited to the purpose are limited to alum, ferric chloride, lime, and an impure sulphate of aluminium called "alumina ferric." Lime is only included in the above list on account of its cheapness, and though not nearly so effective in its action as any of the others, its use is still practical. The best agents for the purpose are ferric chloride and alumina ferric.

Experiments carried out with muddy water in an open waterhole showed that, in one case, water was cleared in one night by the addition of ferric chloride at the rate of 1 lb. to 1,000 gallons of water, while in another five hours only were needed, though in this case 2 lb. of ferric chloride were used to 1,900 gallons of water.

Alumina ferric has also been found to be very effective when used at the rate of 1 lb. to 3,000 gallons of water. Alum is less effective than ferric chloride, pound for pound, experiments indicating that 2 lb. alum is equivalent to 1 lb. ferric chloride.

Ferric chloride and alumina ferric should be applied by dissolving in water, diluting to the required strength, and then throwing the solution over the surface of the water to be cleansed as evenly as possible. The surface layers of the water should be stirred gently with a long pole.—A. A. Ramsay, Principal Assistant Chemist.

Some Suggestions on Spray Management.

[Concluded from page 285.]

W. J. ALLEN and W. LE GAY BRERETON.

Care of Spray Plant.

MUCH economy can be effected by proper care of all parts of the plant.

The Engine.—The majority of people admire a well-kept engine exposing a mass of highly-polished steel and brass, but it must be borne in mind that a fire, factory, or other engine, with a driver and often one or more assistants in constant attention, much of whose time during their watch can be spent on polishing, is running under very different conditions to the engine of a spray outfit. In the latter case the nozzle-men in charge of the outfit are fully employed in their primary duty of applying spray to the trees. Moreover, though the engine should have some form of protective hood from the drift of the spray, such a hood is never wholly effective. The makers of most outfits apparently understand these conditions, and very wisely cover the exposed parts of the engine, with the exception of the bearings, with a heavy coating of a durable paint to obviate as far as possible the maintenance of polished metal. The transport and tank will also become coated with various spray mixtures during spraying and filling operations, and to keep these parts spick and span would be nothing short of foolish waste of time.

It must not be forgotten, however, that the engine is expected to work under somewhat trying conditions, and with nobody giving it undivided attention, how to keep up its efficiency must be considered. It has already been shown that when working with a supply cart one nozzle-man is free during filling operations to look over the engine after each run, to see that all nuts and working parts are right and that lubricating cups are full and feeding before starting again. This should not be neglected, as many a trouble which might otherwise cause a serious breakdown, loss of time and expense in repairs, can be nipped in the bud. The nozzle-man in charge can also take a glance during a run at the sight-feed lubricator that is generally provided for oiling the cylinder; he will soon get used to the noise of the machinery running, and if any abnormal noise occurs should at once investigate. If cared for in this way the engine will come in at night with all working parts oily, and will not require attention when being put away, though such parts should be rubbed over and freshly oiled before starting the next morning.

The cleaning of internal parts can generally be managed so as to avoid it having to be done during a spraying period, and except in very dry climates or seasons it is a job that can often be reserved for wet days.

Before putting the engine away for any lengthy period all working parts should be wiped down and well swabbed with oil. The outfit should be kept under cover from the weather.

The pump should be rinsed every night on completion of spraying. Care should be taken in doing this first to rinse the tank out and then pump

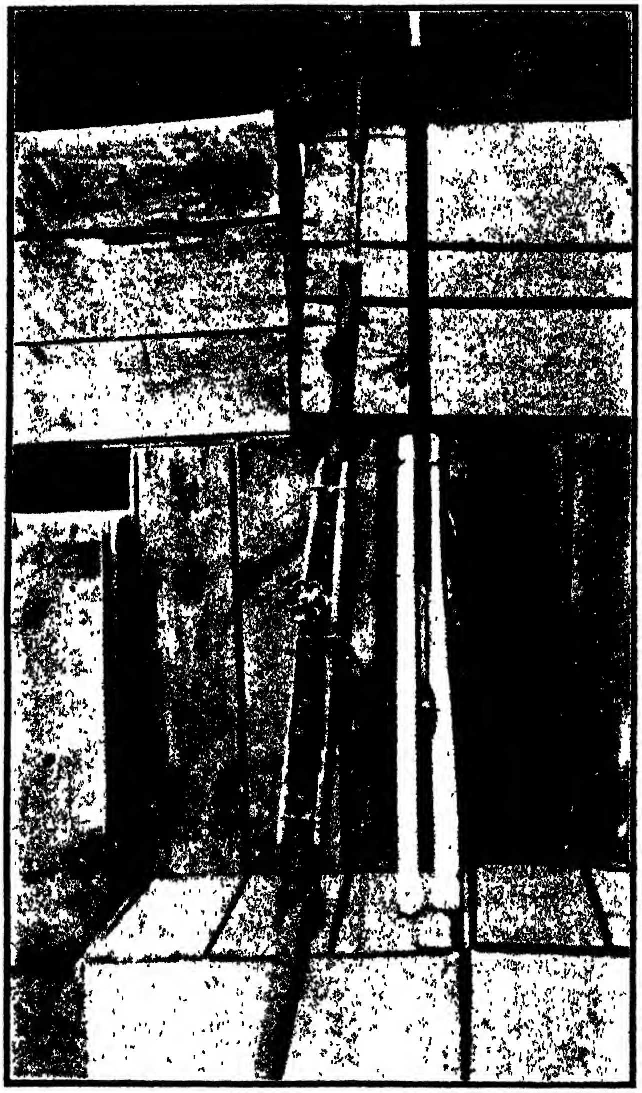


Fig. 11.—Showing $\frac{1}{4}$-inch gas piping used for spray rods, fitted with old spray hose as a grip, and with slats to prevent the hose being cut on the metal lining of the union.

through clean water with the hoses off to give a clear outlet. This can be neglected if oil sprays are being used that do not cake around the valves or chambers, nor corrode the metal.

The Hose.—The hose should be rinsed every night by pumping water through it with the nozzles off to give a clear outlet; if oil has been used soda should be dissolved in the water used for rinsing, a cask of prepared soda solution for this purpose being kept on hand during spraying operations. The operation should be carried out either after the pump has been first thoroughly rinsed, or with a separate small pump. Care in this way will lengthen the life of the hose to a very appreciable extent.

The thorough drying out of the hose when put away has not been found to be necessary; in fact, provided it is from clean water, moisture in the hose is possibly beneficial. Avoid, however, hanging the hose close up to an iron roof or in any hot place. It should be kept covered with bagging or similar material.

It will be found that during use the hose is liable to cut on the inside metal lining of the union with the rod, and loss of a couple of inches of hose quite frequently results. This can be prevented by placing two thin slats of wood on each side of the hose, extending 8 or 9 inches along the hose beyond the union and about the same distance along the rod. This can be twitched on with three wires. A piece of old felt hat or, better still, a piece of old inch hosing may be placed around the hose where the ends of the slats (which should have the inside edges rounded off) come in contact with the hose to prevent cutting from the outside (see Fig. 11). This prevents the hose hanging down on the inside metal lining and being cut. There are on the market metal bells combined with a most simple and efficient fastening which takes the place of the more primitive method described above. The hose should be tied with a piece of lashing to prevent dragging and cutting on the metal lining of the union connecting it with the pump.

Extension Rods.—Particular attention may be directed to the use of quarter-inch gas-piping for extension rods, as illustrated in Fig. 11. Such piping will be found most satisfactory in this connection. It is not too heavy, and if it is rinsed when the hoses are rinsed will stand hard usage and last for a long time, even when corrosive materials like lime-sulphur are used through it. The inside certainly corrodes a little, but the corroded portion may be prevented from coming away during spraying and choking the nozzles if it is scraped occasionally by running a piece of fencing wire backwards and forwards through the piping. As some indication of the life of gas-pipe rods it may be mentioned that a pair of such rods were put into use at Glen Innes in 1907 and were still effective in 1920. To give a better grip, and also to act as an insulator if hot sprays are being used, a piece of old spray hose should be threaded on them (see Fig. 11).

Often the trees in various blocks in an orchard are of varying ages and heights, and by the use of quarter-inch sockets and extra lengths of quarter-inch piping the rods can be lengthened as desired.

Nozzles.—Except when oil sprays are being used, nozzles should be unscrewed, rinsed, and a little grease or oil put on the threads or worms. When this is neglected for any length of time, especially during the use of

lime-sulphur, there is danger of the parts corroding together and it becoming almost impossible to take them apart when it is necessary to clear a chokage in the nozzle.

Fig. 12.—Showing operator with eyes protected with a piece of calico tied over hat. The material can be drawn still further over the face without obstructing the wearer's view. The illustration shows also a handy one-piece overall.

Taps.—Taps used for spray material, either on the pumps or mixing barrels, should have a little oil run through them from time to time, and should be thoroughly rinsed and oiled inside before being put away. Treated in this way they will turn easily and last a very long time, but if neglected will very soon become useless.

Buckets.—The life of buckets used for handling sprays can be materially prolonged if painted, say, with red oxide or red lead and oil before they are first used. This can be renewed from time to time, especially round the seams inside. Opportunities can be taken to do this on wet days when other work is held up. It is a good plan always to rinse and leave the buckets upside down when not in use, so that any spray mixture residue may not remain about the seams.

Open Casks.—Open casks should be kept filled with water to prevent them drying out, and they should be kept covered with old bags to check evaporation, or they will require constant filling up, which is tiresome during a busy time, while the loss of water is no small consideration in dry districts where the supply is limited.

How to be Happy though Spraying.

Spraying is generally looked upon as a disagreeable job, but anybody who complains about spraying when working an efficient power machine should be prescribed a long course on a hand outfit. It is not proposed in the present notes to give directions how to manage men—that is one of the very many subjects that cannot be taught by either articles or lectures—but a hint or two as to how some of the unpleasant features of the work may to some extent be eliminated might well start with a reminder of the value, quite apart from the direct economic value, of a method making for expedition.

It is only human nature to feel in better spirits when connected with a smooth-going concern, and this is noticeable on any job. If everything is running well and good progress is being made it is only the slack and uninterested operator who will not feel a corresponding satisfaction and keenness. If, on the other hand, either through hitches or bad management, progress is slow, the opposite effect will be reflected throughout the gang. This is just where efficient spray management comes in. On a job that is not the most pleasant, expeditious methods have the added advantage that the work is prolonged not a moment longer than is necessary.

Again, just as smooth and effective work tends to keen and cheerful operators, so do satisfied operators tend to smooth and effective work. The man in charge of spraying operations, as of any other kind of work, will find it a good policy to exercise a reasonable amount of tact. Spraying, to be successful, must be thorough throughout, and faulty work must be quickly corrected, but it is well to choose the right moment, or more important perhaps, to avoid the obviously wrong one. The man with an eye full of lime-sulphur, for instance, is not in just the best mood to accept correction.

The spray boss should endeavour to reduce the unpleasantness of the work without reducing its quality or speed. Protection to the eyes is one of the main things to look to in this respect. The writers have tried many methods. Goggles at first seemed a bright idea, but their weakness is that they fog immediately a drift of spray blows across them. It is most often the side drift of spray from the other man's nozzle, or a drip from a high-spreading tree when looking up, that catches the eye, and the best protection has been found to be a large handkerchief or piece of calico over the top of a wide-brimmed felt hat tied under the chin so that the brim and handkerchief project well out beyond the face, only a narrow space being left to look out from (see Fig. 12). Though this offers good protection it does not impede the sight for spraying. Fig. 12 shows also a good type of overall made from stout calico or light canvas.

The Department of Agriculture has inquiries from confectionery manufacturers for pop corn, a price of 15s. per bushel being mentioned. Farmers who desire further information, might communicate with the Under Secretary, Department of Agriculture, Sydney.

Further Experiments with a Spray Gun.

W. J. ALLEN and W. LE GAY BRERETON.

THE subject of the utility of the spray gun was discussed in this *Gazette* in December, 1919, the article in that issue comprising a report of tests carried out with a gun imported for trial from America. The tests showed that the gun had failed to give the long distance spray which should constitute such an article's chief advantage, the object being to eliminate the need for very long rods, and on these grounds the results were not considered satisfactory.

Another gun has now been tested at Glen Innes Experiment Farm orchard, this time with more promising results. In this case the gun gave a satisfactory long distance spray, the fine jet showing, as will be seen by the table of results, an advantage over the double nozzles both in time and the amount of spray used when tested on tall trees requiring a rod 10 ft. 4 in. long. On the lower trees, which only necessitated the use of 8-foot rods, double nozzles showed a lower consumption of spray per tree, but the gun showed a saving in time. Which would be the more economical would depend on the cost of spray used and cost of labor.

The trees the gun was tested on were trained on a distinct leader system such trees are well adapted for systematic work with rod and nozzles. There was no opportunity of testing it on trees that had been allowed to depart from the leader form, or on citrus trees on which such methodical work could not be carried out; but judging from the work done with the gun, it seems probable that even on low trees of the latter form it would be more satisfactory than rod and nozzles. Continual use of the gun over at least a full season under comparable conditions will be necessary before a definite opinion can be given as to whether there is any difference in the thoroughness of the work done by the gun and the nozzles, and whether the gun will be satisfactory with all classes of sprays, such as lead arsenate, or fungicides and such contact sprays as tobacco extracts for aphis.

The operator expressed the opinion that 8-foot rods were more convenient to use than the gun, but that the gun was more convenient than the 10-foot rods.

The test was carried out with lead arsenate spray, and the weather was calm. There is some doubt whether lime-sulphur could be applied with the gun in weather that was at all windy, for it is quite certain that the operator can avoid the spray far better from angle nozzles on a rod than from the gun. The operator was given practice with the gun, and the tests were not started until he felt accustomed to its use; but he is a first-class nozzle-man of long experience, while he was new to the gun, and it is likely that the tests were in favour of the nozzles, and that with greater familiarity with its manipulation the gun will give still better results.

It was intended to make the tests at various pressures, but owing to the engine governor being slightly out of order it was not possible to maintain an even pressure of over 250 lb., hence this pressure only was used. When the engine is in good order the fluctuation would be only 20 lb., or at the outside 25 lb., but for the reasons given above the pressure varied from 250 lb. to 290 lb., the guage indicator chiefly fluctuating between 265 lb. and 285 lb. A ½-inch hose only was used. In all cases the spray was measured in, but as the pump will not drain the tank dry unless it is tilted up, and as the quantity left in the tank varies according to the slope the outfit happens to be standing at, the residue was drained off after each run and subtracted from the full quantity measured in.

The rods used were furnished with slats to prevent the hose from being cut on the metal lining of the union; these slats give an extra length of about 9 inches to the rod when required. Two series of tests are shown in the accompanying table. The first was carried out on an even lot of Dunn's apple trees, but in view of the fact that the average size of the trees subjected to one treatment varied from that of the lot subjected to another, experiments were also carried out on some rows of pear trees, the different

ANALYSIS of Tests on Apple and Pear Trees.

Appliance.	Pressure.	Quantity of Spray.			Total number of trees.	Average size of four trees.	Time taken.	Time per tree.	Quantity per tree	Remarks.
		Total.	Residue.	Net.						
		gals.	gals.	gals.			mins.	mins.	galls.	
Series 1.										
1. Gun. Medium jet; diameter of orifice, ·114 inch.	250-290 lb., chiefly 265-285 lb.*	80	4¼	75¾	15¼ (Dunn's apple).	Height, 14 ft. 6 in.; diameter of spread, 16 ft.	22	1·44	4·93	. . . ..
2. Gun. Fine jet; diameter of orifice, ·096 inch.	"	80	5¾	74¼	16¼ (Dunn's apple).	"	31	1·97	4·56	Trees rather larger than in 1.
3. Double nozzles on rods; two leads of hose.	"	80	4¾	75¼	20 (Dunn's apple).	"	24	2·4†	3 77	Trees of about same size as 1.
Series 2.										
1. Gun. Medium jet; diameter of orifice, ·114 inch.	"	40	3¾	36¼	7 (pear) ..	Height, 19 ft. 3 in.; diameter of spread, 19 ft. 2 in.	10	1 42	5·17	......
2. Gun. Fine jet; diameter of orifice, ·096 inch.	"	40	4¼	35¾	10 (pear) .	"	16	1 6	3·57	Plug of cut-off valve flew out at finish and some spray was lost, which would have otherwise been in that measured off. This total used was something less than 35¾ gallons.
3. Double nozzles on 10 ft. 4 in. rod; single lead of hose.	250-280 lb.‡	40	4¾	35¼	9 (pear) ..	"	19	2·1	3·91	.... .

* The reason for the excessive fluctuation in pressure is given in the text.

† As two leads of hose were used in this case, requiring two men for the operation, the 1·2 minutes actually taken per tree has been doubled.

‡ When only a single lead of hose was used the pressure fluctuated to a less degree.

treatments in this case being applied to the same trees. The sizes of the trees in the table are only given in order to furnish some idea of the type experimented on, and the figures are only approximate, being averages of four trees out of each lot. It may be pointed out that the height and spread of the tree cannot be taken as the sole indication of the quantity of spray needed. The density of the tree is also an important factor.

Tests were also carried out on a pine tree to ascertain what height could be reached with the gun. The heights given were those obtained when the gun was operated by a man of average height, standing upright and holding it, not in a vertical position, but at the angle ordinarily employed when spraying a tree. The results were as follow:—

Jet used.	Pressure.	Approximate height.
	lb.	ft. in.
Medium	200-225	28 0
	250-290	29 0
	300	31 0
Coarse	250-290	36 6

The quantity of spray delivered through the medium jet with the gun set at long distance under pressure of 250–290 lb., was 40 gallons in 11 minutes, or 3·636 gallons per minute. This was when connected to the pump with ½-inch hose. It is quite possible that the use of a larger hose, say ⅝ inch or ¾-inch, would make a material difference in the rate of delivery, as the pressure is necessarily registered at the pump and the smaller hose would reduce the pressure more at the point of discharge than a larger one.

In conclusion it may be said that although further tests covering a long period are necessary in order to compare the work of the gun with that of the nozzle, the authors of this article feel convinced that the gun is a valuable addition to spray appliances, especially on trees which would otherwise necessitate the use of extremely long rods. Moreover, the gun would be a useful standby where through any reason the nozzle team was a man short, for the single nozzle man could carry on the work with the gun faster than single-handed with the nozzles.

Use Sturdy Posts in the Vineyard.

Because of the many stresses and strains put upon them in the vineyards, posts used to support grape vines should be of sturdy construction. Disturbances due to cultivation, rain, winds, and the weight of vines and fruit, soon cause the most orderly vineyard to become tumble-down and ramshackle in appearance. The breaking of a post at harvest time results in a considerable loss of fruit by bruising or rot and prevents the grapes from ripening evenly.

Posts, therefore, that will resist these various agencies and will remain in place winter and summer are of decided advantage to the grape producer. Not only do such posts assure better and more grapes, but they allow the time formerly used for repairs to be put to more remunerative purposes.—C. L. Saunders, in "Better Fruit."

Egg-laying Tests at Hawkesbury Agricultural College.

(Under the Supervision of James Hadlington, Poultry Expert.)

Twenty-first Year's Results, 1922–23.

F. H. HARVEY; Organising Secretary.

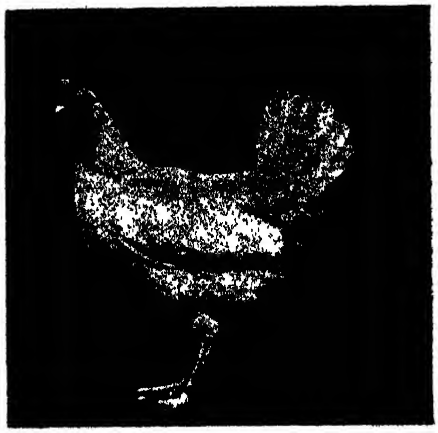
The Twenty-first Egg-laying Competition at Hawkesbury Agricultural College concluded on 31st March, and the record of the results follows. The competition was controlled by a committee of management, comprising four officers of the Department of Agriculture and three competitors' representatives, namely, the College Principal (Mr. E. A. Southee), Messrs. James Hadlington (Poultry Expert, Department of Agriculture), C. Lawrence (Poultry Instructor, Hawkesbury Agricultural College), A. E. Brown, C. Judson, and E. T. Rhodes (competitors' representatives), and F. H. Harvey (Department of Agriculture), Organising Secretary.

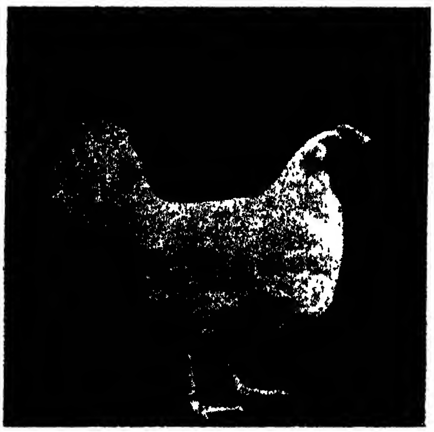
Scope of the Competition.

The competition embraced four sections, namely, open sections for light and heavy breeds, and standard sections for light and heavy breeds. This marks the fourth year in which competitions were provided for standard-bred birds, the qualification for entry in these sections being that the owner had won a first, second, or third prize with the particular breed entered in an "open show class" at an approved exhibition held in New South Wales during the previous three years.

The competitions were limited to pullets between 7 and 12 months old on 1st April, 1921, and pens were allotted as follow :—

	Groups.	Birds.		Groups.	Birds.
Section A.			*Section C1.*		
Open Light Breeds :—			Standard Light Breeds :—		
White Leghorns ...	48	288	White Leghorns ...	3	18
Minorcas	2	12	Brown Leghorns ...	2	12
Section B.			*Section C2.*		
Open Heavy Breeds :—			Standard Heavy Breeds :—		
Black Orpingtons ..	18	108	Columbian Wyandottes	1	
Langshans ...	9	54	Silver Wyandottes ...	1	
Silver Wyandottes ...	1	6	Black Orpingtons ...	1	6
Plymouth Rocks ...	1	6	Langshans	1	6
White Rocks	1	6	Plymouth Rocks ...	1	6
			Total	90	540

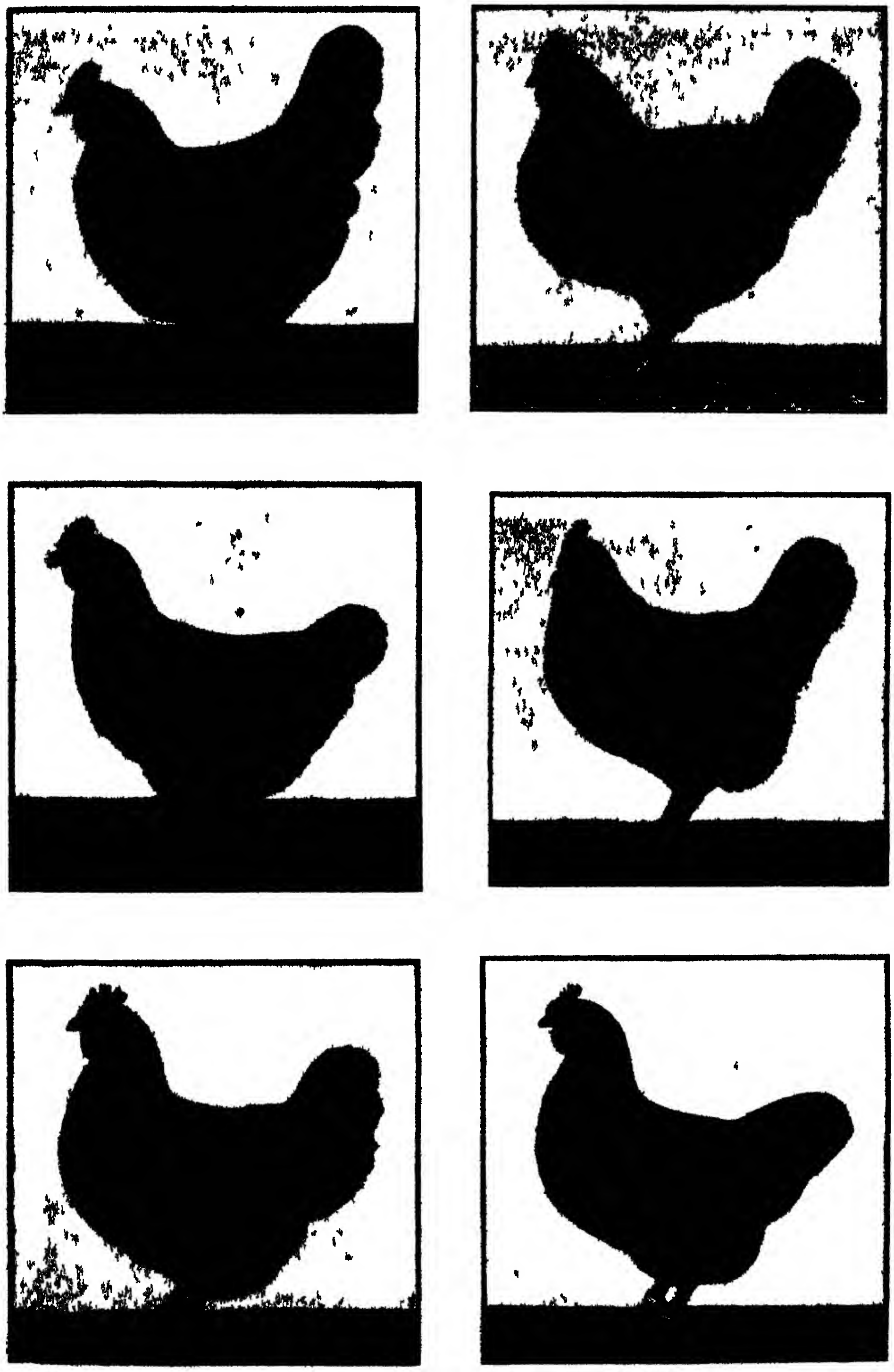




Five of Mr. H. J. Cox's group of White Leghorns. (The sixth bird did not prove a good subject for the camera.)

Greatest number of eggs in the Twenty-first Annual Competition (1,425 eggs.)

A—This hen (No. 275) laid 273 eggs, securing second prize for number of eggs laid by an individual hen in the Light Breeds Section.



G. Jobling and Sons' group of Black Orpingtons.

Greatest number of eggs (1,417) in the Heavy Breeds Section.

Ration laid down for the Competition Birds.

The birds were fed on a simple ration, which is best expressed as follows :—

The Morning Mash.		The Evening Ration of Grain
Pollard	60 per cent.	Two-thirds wheat.
Bran	20 ,,	One-third crushed maize.
Lucerne meal*	15 ,,	
M.I.B. meat meal ...	5 ,,	

Common salt was added at the rate of 4½ oz. to each 20 lb. (or bushel) of mash.

* During the test it was found that the lucerne meal was somewhat inferior, and this item was eliminated from the ration for a considerable time. Of course, the ration was adjusted by an increase in bran and pollard.

The nutritive ratio of the above feed for the day is approximately 1 to 4·5.

Mixing Mash for Adult Birds.—The proportion by weight of bran or bran and lucerne dust is added to the meat meal; then there is poured over it sufficient liquid into which has been dissolved a quantity of common salt equal to 4½ oz. for each 20 lb. of food to be mixed. The bran then resembles a wet mash in the form usually given to horses or cattle; the proportion by weight of pollard is then mixed thoroughly into a mash of a consistency that can be balled by the hands under slight pressure, and will fall to pieces when thrown down. Should the pollard be of coarse description, less bran is used. On the other hand, should it be fine, more bran is used. The nutritive value of both is so nearly identical that, from that point of view, the proportions are immaterial.

As much chaffed green lucerne as the birds will eat is given at midday. The shell grit supplied consists of two-thirds sea-shell to one-third crushed oyster shell. This is, of course, always available to the birds.

Weight of Eggs.

The regulation that individual hens must lay eggs of at least 2 oz. each and that eggs from groups must average at least 24 oz. per dozen within six months of the commencement of the competition, in order to be eligible for prizes, resulted in the disqualification of eight individual hens, as follows :—

Disqualified from Individual Prizes.

Light Breeds.—Escott Poultry Farm (No. 327); J. Gillies (No. 331); F. S. Horner (No. 354); T. E. Jarman (No. 360).

Heavy Breeds.—Anderson Brothers (No. 112); A. E. Brown (No. 116); L. D. Norman (Nos. 171 and 192).

Disqualified from Group Prizes.

Light Breeds.—J. Gillies.

Heavy Breeds.—L. D. Norman.

Mortality and Disease.

The mortality for the year was somewhat higher than in the preceding year, being thirty-four, as compared with thirty-one. The details were :—

	1921-22.		1922-23.	
	Light Breeds.	Heavy Breeds.	Light Breeds.	Heavy Breeds.
Birds replaced	3	5	1	2
Birds not replaced	7	16	19	12

The Monthly Laying.

Month.	Section A. Open Light Breeds.		Section B. Open Heavy Breeds.		Section C1. Standard Light Breeds.		Section C2. Standard Heavy Breeds.	
	Total for 300 hens.	Average per hen.	Total for 180 hens.	Average per hen.	Total for 30 hens.	Average per hen.	Total for 30 hens.	Average per hen.
April, 1922 ...	2,129	7·3	1,410	8·08	184	6·1	237	7·9
May, " ...	2,519	8·4	1,902	10·6	138	4·6	265	8·8
June, " ...	3,476	11·58	2,726	15·14	241	8·03	368	12·26
July, " ...	4,951	16·5	3,660	20·03	425	14·1	551	18·4
August, " ...	5,889	19·6	3,887	21·6	574	19·1	659	20·2
September, " ...	6,619	22·1	3,973	22·1	663	22·1	640	21·3
October, " ...	6,999	23·3	3,640	20 2	678	22·6	649	21·6
November, " ...	6,364	21·2	3,068	17·0	595	19·8	529	17·6
December, " ...	6,270	20·9	2,758	15·32	598	19·9	521	17·4
January, 1923 ...	5,545	18·5	2,511	13·9	502	16·7	479	16·0
February, " ...	4,341	14·47	2,181	12·12	413	13·8	375	12·5
March, " ...	3,394	11·3	2,089	11·6	258	8·6	325	1 8
	58,558	195·2	33,850	188·0	5,269	175·6	5,598	186·6

Twenty-first Annual Competition.—*Analysed.*

Section	Eggs per Hen	Average weight of eggs per dozen	Value per Hen.
	Open Light.		£ s. d
288 White Leghorns ...	197	26	1 8 9
12 Minorcas	135	27	0 19 8
	Open Heavy.		
108 Black Orpingtons ...	198	26	1 8 10
48 Langshans ...	180	26	1 6 3
6 Plymouth Rocks ...	171	24	1 4 11
6 Silver Wyandottes ...	140	24	1 0 5
6 White Wyandottes ...	121	23	0 17 8
6 Rhode Island Reds ...	199	26	1 9 0
	Standard Light.		
18 White Leghorns ...	182	26	1 6 6
12 Brown Leghorns ...	166	25	1 4 2
	Standard Heavy.		
6 Langshans	199	26	1 9 0
6 Silver Wyandottes ...	180	24	1 6 3
6 Black Orpingtons ...	202	28	1 9 5
6 Plymouth Rocks ...	197	24	1 8 9
6 Columbian Wyandottes	155	26	1 2 7

Scores of Leading Birds.

The following table shows the monthly records of the birds in light and heavy breeds which won prizes for individual scores :—

Owner and Breed	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
					Heavy Breeds.								
D. Kenway : Black Orpington	18	15	19	23	24	26	28	29	27	26	25	23	278
C. Judson & Sons : Black Orpington	19	25	25	26	27	25	27	24	18	26	21	14	277
R. Mallard : Black Orpington	22	19	19	22	24	26	29	25	25	17	19	23	270
C. Watts : Black Orpington	15	8	20	25	26	30	30	29	28	13	18	26	268
R. Mallard . Black Orpington	20	20	20	23	24	24	21	23	24	24	22	22	267
					Light Breeds.								
B Clarke : White Leghorn	24	26	23	27	27	28	28	24	31	19	12	12	281
H. J. Cox : White Leghorn	21	21	20	22	24	24	26	24	19	29	22	21	273
P. R. Barsby : White Leghorn	19	19	21	23	23	25	24	25	26	20	21	19	265
G. Hopping : White Leghorn	8	14	23	19	29	28	27	29	11	26	25	27	261
F. S. Horner : White Leghorn	21	22	20	16	24	26	23	19	24	23	19	23	260

Weights of Winning Birds.

The weights of the winning birds at the beginning and end of the competition should be of interest, particularly the fact that practically no change occurred in weights of the winning team in light breeds. They were :—

		Weight at April, 1922.		Weight at March, 1923.	
Individual Hens.		lb.	oz.	lb.	oz.
Light Breeds—					
B. Clarke's White Leghorn, No. 253 ...		3	10	4	8
Heavy Breeds—					
D. Kenway's Black Orpington, No. 58 ...		5	0	5	2
Groups.					
Light Breeds— H. J. Cox's White Leghorns, Nos. ...	271	3	12	3	12
	272	4	0	4	0
	273	3	12	3	12
	274	3	12	3	12
	275	3	12	3	12
	276	4	4	4	8
Heavy Breeds— G. Jobling & Son's Black Orpingtons, Nos.	37	5	4	5	4
	38	5	0	5	12
	39	5	6	5	0
	40	5	0	4	14
	41	5	0	5	8
	42	5	4	6	0

The Financial Aspect.

The cost of feed for the 540 birds for the year was £293 9s. 6d., representing:—

			£	s.	d.
Wheat	382 bushels	19 lb. ..	120	5	8
Maize	122 ,,	38 ,, ..	37	10	1
Pollard	793 ,,	0 ,, ...	79	13	1
Bran	263 ,,	12½ ,, ..	24	11	6
Lucerne meal	8 cwt.	23½ ,, ...	4	6	8
Green feed	83 ,,	94 ,, ..	4	14	0
Meat meal...	15 ,,	88 ,, ...	14	0	11
Common salt	284 lb.	4 oz. ...	0	19	1
Epsom salts . ..	52 ,, ...	.. ..	0	7	3
Shell grit	3 tons...	.. ...	7	1	3

The average cost of feed per head was thus 10s. 10d.

The market value of the eggs laid was £810 18s. 5d., so that the profit over cost of feed was £441 6s. 6d., equal to 16s. 4d. per head.

Annual Competition.

Full details of the financial and other results since the inception of the competitions are given in the following comparative table:—

	No. of Groups.	Winning Total.	Lowest Total.	Highest Monthly Total.	Average per Hen.	Average Net Price of Eggs.	Average Value per Hen.	Cost of Feed per Hen.	Balance over Feed.
1st ...	38	1,113	459	137	130	1/1	15/6	6/-	9/6
2nd ...	70	1,308	666	160	163	1/3¾	17/9	5/9¾	12/-
3rd ..	100	1,224	532	154	152	1/-	12/9	4/5½	8/3
4th ...	100	1,411	635	168	166	-/11¼	13/3	5/3½	8/-
5th ...	100	1,481	721	162	171	1/0½	14/10	5/10	9/-
6th ...	60	1,474	665	161	173	1/2¼	17/2	7/-	10/2
7th ...	50	1,379	656	159	180	1/3¼	19/2	7/9½	11/4
8th ...	60	1,394	739	158	181	1/5¼	21/9	6/9	15/-
9th ...	40	1,321	658	151	168	1/2	16/3½	6/5½	10/2
10th ...	50	1,389	687	146	184	1/2½	18/5½	6/1½	12/4
11th ...	50	1,461	603	156	178	1/3½	19/4¼	7/3½	12/0¾
12th ...	50	1,360	724	152	177	1/2½	17/7	5/9	11/10
13th ...	63	1,541	705	162	181	1/2	17/8½	6/9½	10/11
14th ..	70	1,449	506	165	192	1/4½	22/2	7/7	14/7
15th A	40	1,526	924	162	216	1/3¾	28/8¾	6/10	16/10¾
15th B	30	1,479	749	165	192	1/3¾	21/7½	6/10	14/9½
16th A	40	1,525	923	157	209	1/4	21/9¾	7/8	14/1¾
16th B	30	1,613	931	170	202	1/4	21/2	7/8	13/6
17th A	40	1,448	860	153	199	1/5½	22/0½	7/10	14/2½
17th B	30	1,517	815	151	189	1/5½	21/11¼	7/10	14/1¼
18th A	30	1,438	988	148	203	1/10	28/10	9/3	19/7
18th B	50	1,428	745	151	190	1/10	28/1	9/3	18/10
18th C1	3	1,304	977	138	195	1/10	27/8	9/3	18/5
18th C2	7	1,336	955	150	191	1/10	28/5	9/3	19/2
19th A	33	1,516	996	167	206	2/2	37/11	12/8	25/3
19th B	47	1,488	955	168	204	2/2	37/11	12/8	25/3
19th C1	5	1,425	944	148	195	2/2	36/-	12/8	23/4
19th C2	5	1,298	1,020	150	193	2/2	35/9	12/8	23/1
20th A	45	1,480	881	157	196	1/11	30/10	11/9	19/1
20th B	35	1,457	696	160	192	1/11	31/2	11/9	19/5
20th C1	5	1,092	885	144	168	1/11	24/7	11/9	12/10
20th C2	5	1,370	1,092	147	197	1/11	33/5	11/9	21/8
21st A	50	1,425	646	164	195	1/9	28/5	10/10	17/7
21st B	30	1,417	720	164	188	1/9	27/5	10/10	16/7
21st C1	5	1,220	864	149	176	1/9	25/8	10/10	14/10
21st C2	5	1,212	931	144	187	1/9	27/3	10/10	16/5

AWARDS OF PRIZES AND CERTIFICATES.

Grand Champion Prize.

Grand Champion Prize, value £5 5s., for group of six birds laying eggs of greatest market value, without replacement of a bird—A. R. Kennedy's Black Orpingtons, market value, £8 18s. 9d.

Section Prizes.

Greatest number of eggs laid in twelve months (individual hens)—

Light Breeds:—B. Clarke, 281 eggs, £3; H. J. Cox, 273 eggs, £2 10s.; P. Barsby, 265 eggs, £2; G. Hopping, 261 eggs, £1 10s.; F. S. Horner, 260 eggs, £1.

Heavy Breeds:—D. Kenway, 278 eggs, £3; C. Judson & Son 277 eggs, £2 10s; R. Mallard, 270 eggs, £2; C. Watts, 268 eggs, £1 10s., R. Mallard, 267 eggs, £1.

Greatest number of eggs laid in twelve months (group of six birds)—

Light Breeds:—H. J. Cox, 1,425 eggs, £2 10s.; P. R. Barsby, 1,414 eggs, £2; F. T. Wimble, 1,409 eggs, £1 10s.; H. S. Morris, 1,366 eggs; £1.

Heavy Breeds:—G. Jobling & Son, 1,417 eggs, £2 10s.; A. R. Kennedy, 1,336 eggs, £2; J. Farrar, 1,328 eggs, £1 10s.; A. E. Jerrett, 1,322 eggs, £1.

Highest average (groups of five or six birds)—

Light Breeds:—H. J. Cox, 237·5 eggs, £3; P. R. Barsby, 235·6 eggs, £2 10s. F. T. Wimble, 234·8 eggs, £2; F. A. Bailey, 230·2 eggs, £1 10s.

Heavy Breeds:—G. Jobling & Son, 236·2 eggs, £3; A. R. Kennedy, 234·2 eggs, £2 10s.; C. Judson & Son, 222·4 eggs, £2; J. Farrar, 221·3 eggs, £1 10s.

Quality Prizes.

Open Sections for groups selected as conforming most closely to standard type, prizes allotted for number of eggs laid.

Light Breeds:—P. R. Barsby, 1,414 eggs, £5; F. S. Longley, 1,342 eggs, £2 10s.

Heavy Breeds:—C. Judson & Son, 1,284 eggs, £5; Mrs. C. B. Ferguson, 1,213 eggs, £2 10s.

Standard Sections:—Prizes allotted for greatest number of eggs laid by Groups

Light Breeds:—C. McKendry, 1,224 eggs, £2; A. H. Burwood, 1,126 eggs, £1.

Heavy Breeds:—W. M. Mulliner, 1,212 eggs, £2; S. S. Mullett, 1,195 eggs, £1.

Quarterly Prizes.

Winter test (1st April to 30th June, 1922)

Light Breeds:—G. Hopping, 281 eggs, £2; P. R. Barsby, 260 eggs, £1 10s.

Heavy Breeds:—A. R. Kennedy, 325 eggs, £2; A. R. Sinclair, 305 eggs, £1 10s

Spring test (1st July to 30th September, 1922)—

Light Breeds:—F. T. Wimble, 420 eggs, £1 10s.; C. McKendry, 401 eggs, £1.

Heavy Breeds:—G. Jobling & Son, and A. H. Moxey, 462 eggs each, divide £2 10s.

Summer test (1st October to 31st December, 1922)

Light Breeds:—E. T. Rhodes, and W. T. Wimble, 470 eggs each, divide £2 10s.

Heavy Breeds:—G. Jobling & Sons, 438 eggs, £1 10s.; J. Farrar, 437 eggs, £1.

Autumn test (1st January to 31st March, 1923)—

Light Breeds:—H. J. Cox, 388 eggs, £2; C. Leach, 374 eggs, £1 10s.

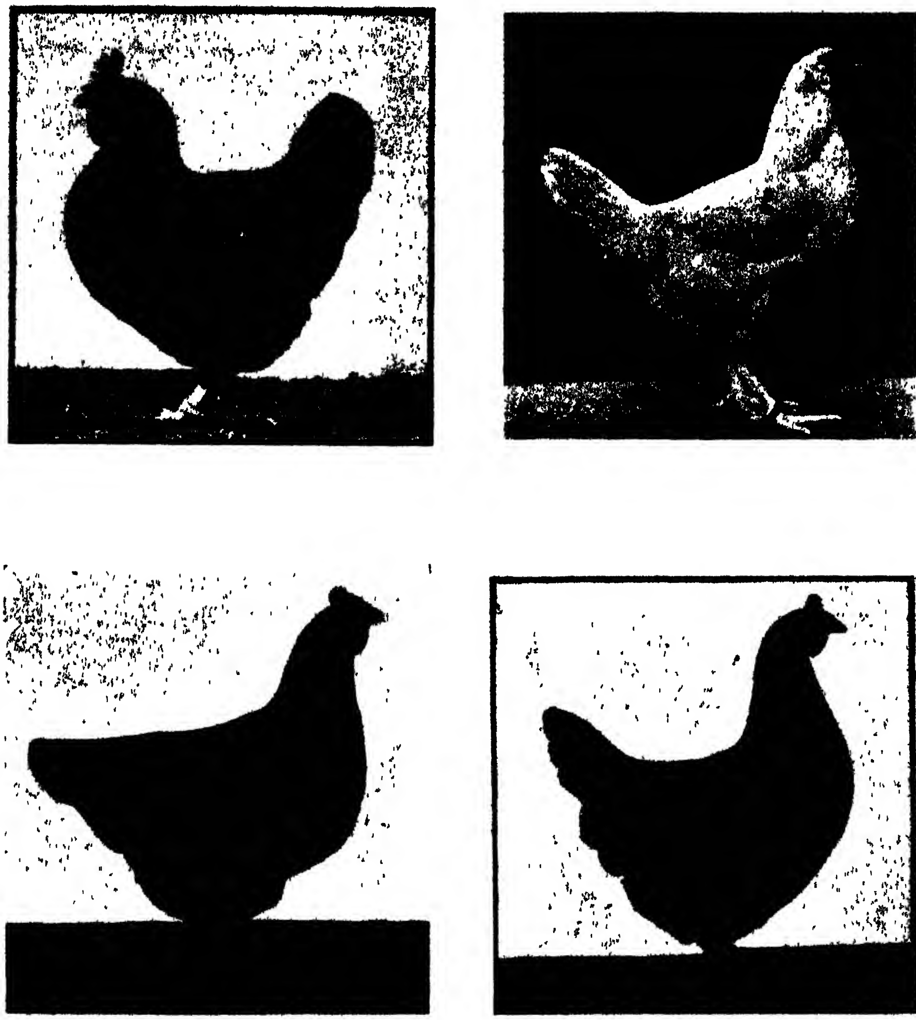
Heavy Breeds:—J. Farrar, 355 eggs, £2; G. Jobling & Son, 335 eggs, £1 10s.

Certificates.

For groups laying 1,350 eggs or more of prescribed weight—

Light Breeds:—H. J. Cox, 1,425 eggs, P. R. Barsby, 1,414 eggs, F. T. Wimble, 1,409 eggs, H. S. Morris, 1,366 eggs, J. M. Brooke, 1,352 eggs.

Heavy Breeds:—G. Jobling & Sons, 1,417 eggs.



The Leading Individual Hens.

Left Top.—Mr. D. Kenway's Black Orpington (No. 58); laid 278 eggs and secured first prize for greatest number of eggs laid by an individual hen in the Heavy Breeds Section.

Right Top.—Mr. B. Clarke's White Leghorn (No. 253), laid 281 eggs and secured first prize for greatest number of eggs laid by an individual hen in the Light Breeds Section, (and in the whole competition.)

Left Bottom.—Mrs. C. Dobbie's Plymouth Rock (No. 540); laid 254 eggs, greatest number laid by an individual hen in the Standard Section.

Right Bottom.—Mr. C. Judson's Black Orpington (No. 48); laid 277 eggs and secured second prize for number of eggs laid by an individual hen in the Heavy Breeds Section.

THE POULTRY EXPERT'S COMMENTS.

Reference to the tallies put up in many former tests will disclose that this competition suffers much in comparison with regard to conspicuous performances. As will be seen, there is a total absence of the 300-egg hen, and also of the 1,500 to 1,600-group performances that obtained in recent years. The absence of these high performances has pulled down the general average considerably. In this competition, as in most of the tests, the laying performance during the first two or three months is shown to have cast its shadow over the whole twelve months. The pullets shaped badly from the start; many went into a moult soon after their arrival at the College, and quite a number went through another partial moult early in the winter. Thus the bad start was maintained right through, and the general average has fallen by two eggs. This, following upon the big drop last year, is not pleasant to contemplate, although in so far as the previous test was concerned, doubtless the two wet months at the commencement of the competition were more or less accountable for some of the falling off.

It was anticipated that the drop would be but temporary. However, it has not proved so, and it behoves us all, both competitors and conductors of these tests, to look to our laurels. It is easy to blame the weather or some other circumstances, when the remedy may be within our own control. Breeding, selection, and feeding are each factors that concern us all. In this connection it might be well right now to look more carefully to the breeding of the birds, lest factors mentioned in recent lectures operate to pull down the good work that has been achieved.

Fluctuations might be expected from year to year, but a falling off in general averages over two or three years might presage something fundamentally wrong, or it may be only a reflex of the difficulties poultry farmers have experienced in obtaining food supplies in recent years. Whatever may be responsible—and I fear no one can be too sure of the causes—it behoves us now while on the threshold of the breeding season to look well to our methods of both breeding and rearing. It is only by taking forethought at the proper season of the year that a better result is likely to accrue.

It has been considered that a good deal of the breaking up of pullets after their arrival at the College is due to the two changes of quarters to which the birds have been subjected. It should not be lost sight of, however, that these conditions have existed during the whole of the last twenty tests; therefore there has been nothing unusual in this last. It remains to be seen if the new order of procedure for the incoming test, when the birds go straight into the pens instead of being changed over as before, and whether the nine days lost in the year on this account, will be compensated for by a less number of birds or groups breaking up. That it will not altogether obviate the difficulty, is well understood.

EGG-YIELDS OF EACH BIRD AND GROUP IN THE TWENTY-FIRST ANNUAL COMPETITION.

Owner and Breed.	Totals of Individual Birds.						Total of Groups.	Weight of Eggs per dozen.
Open Light Breeds.								oz.
H. J. Cox : White Leghorns	171	219	259	254	278	249	1,425	24½
P. R. Barsby : White Leghorns	207*	250	233	257	265	202	1,414	26
F. T. Wimble : White Leghorns	212	211	230*	246	252	258	1,409	25¼
H. S. Morris : White Leghorns	222	245	203	228	255*	213	1,366	25½
J. M. Brooke : White Leghorns	160	239	248	259	220	226	1,352	26¾
F. S. Longley : White Leghorns	203	240	203	241	219	236	1,342	26¼
H. L. Abrook : White Leghorns	201	233	222	246	231	203	1,336	25½
D. R. Dove : White Leghorns	197	257	220	192	250	216	1,332	26¼
E. T. Rhodes : White Leghorns	195	243	226	239	187	239	1,329	25
M. O. Byrne : White Leghorns	218	163	227	245†	254	213	1,320	24¼
J. Gillies : White Leghorns	176*‡	232	214	241	232	222	1,317	23¾
Day Dawn Poultry Farm : White Leghorns	248	214	226	197	212	212	1,309	26
C. Leach : White Leghorns	240	190	239	247	228	165	1,309	25½
Mrs. C. Lewis : White Leghorns	250	198	214	208	183	251	1,304	25½
G. Cole : White Leghorns	241	233	215	210	218	180*	1,297	26¾
W. Maskell : White Leghorns	211	238	178	254	191	217	1,289	26¾
J. L. Waters : White Leghorns	175	200*	231	257	222	200	1,285	27½
Mrs. M. Graham : White Leghorns	233	158	216	223	242	211	1,283	24¾
G. Dunlop : White Leghorns	246	174	185	230	232	164	1,231	25½
F. S. Horner : White Leghorns	260	211	197	151	192	211‡	1,222	24¾
H. C. Bailey : White Leghorns	212	196	194	199	220	199*	1,220	26¼
D. Asher : White Leghorns	246	74†	174	221	251	244	1,210	25
A. Chick : White Leghorns	128	215	225	206	203	211	1,188	27¾
A. Falconer : White Leghorns	190	178	208	169	224	218	1,187	26½
B. Clarke : White Leghorns	281	202*	201	162	174	166	1,186	27
W. Chalmers : White Leghorns	198	180	216	153	218	208	1,173	24¾
F. A. Bailey : White Leghorns	233	185	255	18†	255	223	1,169	24¾
P. McSkimming : White Leghorns	197	226	176	198	145	227	1,169	27
P. J. Paull : White Leghorns	186*	228	177*	182	185	210	1,168	27¾
J. C. Hepher : White Leghorns	202	172	172	194	204	209	1,153	26
E. Smith : White Leghorns	72†	155	223	243	258	201*	1,152	27½
T. E. Jarman : White Leghorns	218	180*	200	256*	94†	201*‡	1,149	24½
Escott Poultry Farm : White Leghorns	133	175	241*‡	236	191	162	1,138	24¼
W. H. Cole : White Leghorns	190	211	165	194	188	185	1,133	24¼
G. A. Mann : White Leghorns	197	133	182	222	212	231	1,127	26¾
G. Hopping : White Leghorns	211	256	64†‡	82	261	252	1,126	25
H. F. Emert : White Leghorns	172	192	185	181	172	215	1,117	26½
Watson and Stepney : White Leghorns	179	229	163	140†	192	198	1,101	27
T. S. Dwyer : White Leghorns	18	201	202	235	207	187*	1,050	27¾
R. W. Baker : White Leghorns	197	173	106	187	160	213*	1,036	26¼
L. A. Ellis : White Leghorns	171	233	199	.	175*	256*	1,034	26
G. A. Baxter : White Leghorns	165	16†‡	201	242	185*	196	1,005	27
J. Rayner : White Leghorns	213	213	128	86	128	235	1,003	26½
A. W. Cloke : Minorcas	151	151	148	165	181	180	976	27½
R. McLean : White Leghorns	219	182	159	121	99	194	974	25¼
W. G. Dickie : White Leghorns	189	202	114	200	168	52	925	24¾
H. A. Rogers : White Leghorns	188	169	164	181	59	146	907	25¾
L. A. Beckett : White Leghorns	146	196	140	169		212	863	26¾
R. C. Cook : White Leghorns	70	155	184	15	149	150	723	25¾
Gilliver Bros. : Minorcas	73†	90	51	149	118†	165	646	26¼
Standard Light Breeds.								
C. McKendry : White Leghorns	214	226	193	204	200	187	1,224	27
A. H. Burwood : Brown Leghorns	200	180	231	208	98†	209	1,126	24¾
T. N. Ayling : White Leghorns	97	198	201	146	186	216	1,044	26
A. Messervy : White Leghorns	143*	174	181	151	197*	159	1,005	26
Turner Bros. : Brown Leghorns	174	109	129	154	141‡	199	869	26

* Signifies bird replaced and score struck out. † Signifies bird dead and score retained.

‡ Signifies bird did not lay eggs of prescribed standard weight of 2 ounces each.

EGG-YIELDS OF EACH BIRD AND GROUP IN THE TWENTY-FIRST ANNUAL COMPETITION—*continued.*

Owner and Breed.	Totals of Individual Birds.						Total of Groups.	Weight of Eggs per dozen.
			Open Heavy Breeds.					oz.
G. Jobling & Sons : Black Orpingtons ..	245	205	251	246	251	219	1,417	25
A. R. Kennedy : Black Orpingtons	201	248	242	165†	239	241	1,336	26
J. Farrar . Black Orpingtons . .	206	239	201	196	231	255	1,328	26
A. E. Jerrett : Black Orpingtons .. .	175	226	251	202	244	224	1,322	24
R. Mallard : Black Orpingtons	164	236	258	267	116	270	1,311	27
A. H. Moxey : Black Orpingtons . .	260	234	203	195	201	211	1,304	24½
A. E. Brown : Langshans	204	215‡	214	257	215	197	1,302	24½
C. Judson and Son : Black Orpingtons .	187	221	207	172†	220	277	1,284	25½
D. Kenway : Black Orpingtons . .	161	149	193*	278	251	233	1,265	25½
Mrs. C. B. Ferguson : Black Orpingtons .	232	197	231	241	122	190	1,213	27½
C. Watts : Black Orpingtons . .	199*	222*	158†	146†	210	268	1,203	25½
J. Waterhouse : Rhode Island Reds ..	122	197	182	233	201	262	1,197	26½
J. Every : Langshans	140	142	179	253	240	242	1,196	26
W. Townsend . Langshans .	198	234	178	241	154	189	1,194	25½
E. C. Lunn : Black Orpingtons	257	172	101†	135†	240	243	1,148	26
Wenholm and Seddon : Langshans .	206	196*	239	208	188	135†	1,124	26
C. Harpur : Black Orpingtons	226	191	154	157	174	202	1,104	25½
A. R. Sinclair : Langshans .	207	133	245	230	239	50	1,104	26½
H. A. Gradwell : Black Orpingtons	174	149†	202	224	156	185	1,090	26
J. Wheller : Black Orpingtons	194	221	85	163	158†	248	1,069	25
J. H. Madrers : Black Orpingtons	224	230	102†	184	241	69	1,050	24½
J. O. Roberts : Black Orpingtons	60†‡	184	163	194	223*	216	1,040	25½
J. D. Martin : Plymouth Rocks	170	96†	168	168	202	223	1,027	24
W. W. Tennant : Black Orpingtons	230	239	105†	188	89†	164†	1,015	26
P. A. Barrett : Langshans	188	176	201	190	140	87	982	26½
A. E. Ross : Langshans .	221	174	39†	187	201	158	980	25½
G. E. Holmes : Black Orpingtons	147	84†	164	180	204	75	914	26
G. H. Howell : Silver Wyandottes .	127	186	110	122	113	182	840	24½
Anderson Bros. : Langshans	120	74†	194	40‡	212	125	765	24½
L. D. Norman : White Wyandottes .	77	184	120‡	*69	142‡	134	726	23
			Standard Heavy Breeds.					
W. L. Mulliner . Black Orpingtons . .	230	197	153	210	181	241	1,212	27½
Stan. S. Mullett Langshans ..	187	195	208	235	218	152	1,195	26
Mrs. C. Dobbie Plymouth Rocks ..	203	216	153	122	234	254	1,182	24½
F. M. Weierter : Silver-laced Wyandottes	161	196	38†	236	241	203	1,078	24½
H. Adams Columbian Wyandottes .	144	213	134	134‡	144	162	931	26

* Signifies bird replaced and score struck out. † Signifies bird dead and score retained

‡ Signifies bird did not lay eggs of prescribed standard weight of 2 oz. each.

AMERICAN EXPERIMENTS IN BUD SELECTION.

IN *Research Bulletin* No. 39, of the University of Missouri Agricultural Experiment Station, V. R. Gardener gives interesting results from a series of bud selection experiments conducted at the station mentioned and at the Oregon Experimental Station.

It was found that apple trees propagated from the high-yielding parent averaged about the same in the quantity and grade of fruit produced as those propagated from the low-yielding parent, there being great variation between the individual trees in each lot Ten successive generations of runner selection from high-yielding and from low-yielding strawberry plants failed to produce strains whose yield was higher or lower than the average of the variety. A considerable number of bud variations selected for propagation proved to be simple fluctuations, incapable of impressing their high-producing or low-producing qualities upon their daughter plants.

Poultry Notes.

May.

JAMES HADLINGTON, Poultry Expert.

We have reached the month when the breeding-pens should be got ready for the coming hatching season. Failure to start putting eggs down in June will probably lead to a less satisfactory result during next autumn and winter.

Mating Up the Breeders.

The season is opportune to direct attention to some of the problems in connection with breeding operations, involving considerations of "in-breeding," "line breeding," and "out-crossing." In this connection I have received requests to publish in these notes, at least the portion of my lecture given at the recent Royal Agricultural Show on "Scientific Breeding of Poultry." The following is the portion of the lecture embracing the subjects mentioned:—

It is not my purpose to attempt to cover all the aspects of breeding poultry, to discuss Mendelian problems, or to traverse the labyrinths of Pearl's "Mode of Inheritance." I shall, as far as possible, confine myself to the practical side of scientific breeding, to something we know, what to avoid, and the fundamental principles that are likely to be helpful to the student or novice in the breeding of poultry.

First, I should like to observe that it is questionable if we have now the number of really skilled breeders of exhibition poultry that we had, say, twenty to twenty-five years ago. If we have, their work is not in evidence in our poultry shows. We are wont to pride ourselves that the quality of the birds exhibited at each succeeding show is better than in former years. I make bold to say that, in comparison with the birds of the period mentioned, this is an exaggeration, except in the case of the Royal Agricultural Society's show, at which there is an improvement; but even this is due to the fact that earlier hatching obtains than in those times, rather than to improvement in the breeds. Competition to get birds ready has resulted in earlier hatching, which has very largely contributed to more numerous better class birds being brought together. I am well aware that this statement will come as a surprise to many of my friends who are more recent recruits to fancy or utility poultry breeding. It is, nevertheless, true; and I shall endeavour to explain why. In the first place, I attribute much of the falling off in skill to too great a reliance on the part of the present-day breeder, on mathematical calculations of blood lines, instead of on selection by judgment based on an understanding of the breed, plus blood

lines. In other words, many present-day breeders of poultry are not wont to study the rudiments of poultry breeding as set out in the standards, but are taking what they conceive to be short cuts to their goal.

As an example of present-day methods, a novice who takes up the breeding of poultry, for either show or utility purposes, instead of first turning his attention to the standards for the breed, and studying type, character, markings, &c., straightaway takes up one of the numerous published charts, all more or less based upon Felch's Chart, and imagines that the following of one of these mathematical propositions is all that is required to perpetuate the qualities present in his parent birds, and even to improve upon them. This is a fallacy. Without altogether condemning these charts, I maintain that in the hands of the uninformed in these matters they are doing incalculable harm to the poultry industry. This is the reason why in my book, "Poultry Farming in New South Wales," no chart is included.

Line, and In-and-in Breeding.

"Line breeding" or "in-and-in breeding," without the knowledge referred to, is the sure way to ruin any breed, instead of improve it. In other words, improvement can only come from enlightened judgment in selection, and such judgment can only be the outcome of a mastery of the details of the requirements that constitute the breed, viz., type. character, colour, markings, &c. My object here is to show that line breeding is not necessarily scientific, and is, in fact, most unscientific unless put into practice in combination with a knowledge of the breeds. Therefore, if we wish to be regarded as scientific breeders of poultry, we have very much to learn, other than how to line breed by chart. What is line breeding? It may be well to explain that line breeding and in-and-in breeding are not synonomous terms. Line breeding is the mating together of birds of degrees of consanguinity. It is the course practised by all expert breeders to a greater or lesser degree, and is the means available to them of fixing any given trait of type, character, or markings; but line breeding without careful selection will almost certainly lead to deterioration. What I wish to make clear in this regard is, that unless the breeder can visualise the points or qualities he desires to perpetuate, he will fail to produce them, even with the same blood, whether by line breeding or any other method. The reason for this is that we have to count always upon reversion. It is not practicable, even with perfect birds, to reproduce these qualities in the whole of the progeny; birds with varying degrees of the qualities present in the parent birds, good, bad, and indifferent, will inevitably result. Now it is precisely here that the necessity for knowledge of the breed is required to enable us to select prepotent specimens from blood relationships that will perpetuate the desired qualities.

After this statement of the case, I would emphasise that line breeding or in-and-in breeding cannot by themselves result in the improvement of our flocks; but they are the instruments, so to speak, by which the work of skilled selectors, by continued selection of successive generations, is more or less fixed to our ideals. However, it might be pointed out that notwithstanding all the skill that can be brought to bear in selection, and the

measure of perfection attained, the breed is never absolutely stabilised, and one or two generations bred without skilful selection will result in the whole of the work being undone. The fact is that atavism will assert itself in spite of all our efforts at stabilisation. Hence it is that the very existence of the breeds as we know them depends largely upon selection.

Methods Open to the Breeder.

There are three courses open to the breeder; (*a*) line breeding, (*b*) in-and-in breeding, and (*c*) outcrossing. The first is the mating together of birds of any degree of relationship, caution being exercised not to breed too closely. The second is explained by chart, the third is the mating together of birds of the same breed, but of different strains. The latter requires some explanation. The advocates of extreme in-breeding will aver that to introduce new blood is to court disaster to an established strain. I would say that the want of new blood has brought disaster to many a strain. As already pointed out, there is no perfect strain, and it often happens that in order to attain greater perfection, birds must be introduced strong in the point or points desired. Here, again, is where a thorough knowledge of the breed characters is absolutely essential. The skilled breeder will rarely make a mistake in the introduction of new blood, because he is armed with the necessary knowledge to guide him. In introducing new blood, he seeks first of all for a breeder who is working on sound lines. He must then take into consideration affinity of type and character. Otherwise disaster is almost certain. It is the rude clashing of types that has to be avoided, and not so much the new blood. This is where mistakes are being made at the present time. Many have become imbued with the idea that out-crossing means ruining the strain. This is, of course, possible if it is injudiciously done. The skilled breeder will prove his new blood before he puts it all through his strain, and it is seldom he makes a mistake.

Purity of Breeds.

One of the greatest fallacies of the present day is to suppose that our breeds are pure in the sense that the scientific mind regards as pure. The fact is that most of our present-day breeds are composite in character and can only be maintained by rigid selection by breeders who have a thorough knowledge of the requirements of the standards for the breeds, and the skill to interpret and apply them. The trouble is that a bird is made up of so many characters in combination, any of which, on Mendelian principles, may be bred pure, as, for instance, comb, lobe, colour, marking, &c.; but our difficulty comes when we have to produce birds in which a combination of characters is regarded as the pure standard. This is why a knowledge of Mendelism, while enlightening us upon the why and wherefore of many factors in connection with breeding, does not in itself, as many imagine, enable us to breed pure to standard. If we turn to the factor of egg production, for example, we are no more able to fix this character than any other in the combination. Notwithstanding some claims that have been made in this direction, we appear very far from being able to breed a strain pure to any degree of egg production. The difficulties in this connection

appear to be almost insurmountable. Dr. Raymond Pearl, in his "Mode of Inheritance," has endeavoured to show that egg production is a Mendelian character, while another investigator, Professor Drydon, says that his researches at Oregon Experiment Station do not support this view. One thing is apparent from all experiements, and it is supported by our Hawkesbury Agricultural College competition records, and that is, that each breed has its own general average, which we can fairly approximate, and that the exceptional high layers, which from time to time emerge, tend to throw back to the general average of the particular breed. The performances of these super-layers have not so far been fixed in their progeny.

If all this be true with respect to systematic breeding, what can be the outcome of the promiscuous in-breeding, as, for instance, by chart not supplemented by a thorough knowledge of the breeds?

Conclusions.

I think I have shown that to attempt to breed poultry on purely mathematical lines by chart is quite futile. But whilst I maintain that the idea of mating on blood lines by chart only is a fallacy that can land us nowhere, it is highly important that we chart the blood lines on which we have carried out our matings. This is the only use we can have for charts. That is to say, we should chart what we have done as a record for future guidance, and not what we are going to do. Selection must come first and charting follow.

With reference to mating by formula, the following is a quotation from Dr. Pearl's "Improving Egg Production," published in 1914 (two years later than his "Mode of Inheritance.")

"It would be very easily possible to make out a system of matings, on the basis of the results of Bulletin 205, showing in great detail how to proceed towards building up a laying strain. Indeed, such specific plans have been worked out by a number of my friends. I have refrained from doing this, however, because it seems to me to be of doubtful practical utility. Lest I should seem to be repudiating both my results and my friends, let me hasten to give the reasons for this doubt. The reasons are general in character, and are found in the fact that such schemes of mating are essentially mechanical, whereas both the things to be bred in accordance with the scheme (the fowls), and those who are to carry out the plans (the poultrymen) are essentially living. Perhaps in final analysis the basis of life may be mechanistic, but certainly living things do not in practical, every-day life behave with that precision and definiteness which we expect from a machine. Being a little acquainted with the frailties of both poultry and poultrymen, I am not optimistic as to the outcome of trying to breed fowls by formula."

Arsenic is rather insoluble in water, and for the purpose of killing green timber is used in the form of arsenite of soda. A useful formula for all kinds of work is arsenic 1 lb., washing soda 1 lb., and water 4 gallons— A. A. Ramsay, Principal Assistant Chemist.

A Casual Enemy of the Bee.

The Dragon Fly (*Hemianax papuensis*).

W. A. GOODACRE, Senior Apiary Instructor.

It is not often noticed that dragon flies give much trouble to the bee-farmer, but during the past season, 1921–22, they became a serious pest in a good number of apiaries. Large numbers of the red-coloured species could be observed flying about the apiary grounds, and in the majority of cases a captured bee was being carried. From the way the bee is held by its captor, it would appear that it is caught from the rear whilst flying, and once

The Common Dragon Fly (*Hemianax papuensis*).

the dragon fly gets a firm hold on the back of the bee there is practically no chance of any opposition, for the bee cannot sting its opponent.

Mr. W. W. Froggatt, Government Entomologist, supplies the following information regarding the dragon fly which should be of much interest to bee-farmers :—

This insect is known under the popular name of dragon fly or "Horse-Stinger." Properly speaking it is not a fly, but a Neuropterus insect with two pairs of powerful, thickly netted wings, and the reason that it is often noticed flying round horses is not that it intends to sting them, but that it

intends to snap up the small flies so often found about animals feeding in the paddocks. The dragon fly under ordinary conditions of life is a useful insect. Its eggs are laid upon water plants, and the larvæ hide among the mud and water weeds at the bottom of ponds of stagnant water and shallow creeks, where also are found most of the mosquito larvæ, upon which the dragon fly larvæ exist. When the larva has gone through its final transformation the perfect dragon fly emerges from the pupal shell, and becomes an active, free flying insect. In this final stage of its life it hawks over the water and any damp places where small flies, gnats, and mosquitoes congregate, and it lives exclusively upon such pests, snapping them up in its powerful jaws as it darts through the air.

When, however, the natural food is scarce, and insects like honey bees are plentiful, the dragon fly may become a serious pest to the bee-keeper and capture and destroy many inmates of the hive. To show how some of the questions of the balance of power in insect and bird life work out, the following instance may be cited. A few years ago a large swarm of dragon flies invaded a bee-keeper's district in Southern Victoria and began hawking honey bees. They were followed by a large army of wood swallows (*Artamus*), which set to work on the dragon flies, and came to be looked upon with favour by the bee-keepers, though under ordinary conditions they like the dragon flies, kill bees, and are shot at sight by the bee-keeper.

May Work in the Apiary.

With the exception of one or two districts where the climate is exceptionally warm, the season for working amongst the bees has closed. The bee-farmer should have already made preparation for wintering his colonies, the bees being made comfortable and compact, with an ample supply of good food available in the hive. With the completion of the wintering work, the apiarist can, if normal conditions have obtained during the autumn, be quite content to leave the hives alone for a few months.

There will perhaps be some anxiety where the conditions during autumn have been adverse, and the colonies are going into winter in a more or less weak condition. It pays well in the cases of weak colonies to give extra attention to see that the small cluster is snug. It is remarkable in how many cases these small colonies will pull round if the spring conditions are normal.

Since the season has now generally closed there is a chance for the bee-farmer to look around and attend to any odd jobs left over during the busy time. There is always a deal of preparation work for the next season, and much of the work carried out during winter months means a big saving during the season, for at that period a man cannot prepare much, and if the work is not done then it means purchase of the material.—W. A. Goodacre, Senior Apiary Instructor.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Growers who have crops suitable for seed purposes are invited to communicate with the Department of Agriculture, Sydney. This should be done in ample time to allow of an inspection of the crop to be made before harvesting.

☛ Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Wheat:—

Bomen	H. M. Hall and Sons, Studbrook, Cunningar.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Canberra	Hughes Bros., Greenacres, Pullabooka, *via* Grenfell.
	H. M. Hall and Sons, Studbrook, Cunningar.
	E. Idiens, Boorowa.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	T. M. Slattery, Mirrool.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
Canberra (ungraded)	Manager, Experiment Farm, Condobolin.
	Meurant Bros., Cundumbul, Molong.
Cleveland	Manager, Experiment Farm, Bathurst.
	W. Burns, Goongirwarrie, Carcoar.
	A. J. Rial, Wolseley Park.
College Purple	Hughston Bros., Hughstonia.
Currawa	Hughston Bros., Hughstonia.
Federation	H. M. Hall and Sons, Studbrook, Cunningar.
	R. McCrone and Son., Bungambil, Mirrool.
	T. M. Slattery, Mirrool.
	Hannett Bros. and Wilson, Wellville, Cunningar.
	E. Idiens, Boorowa.
Firbank	T. M. Slattery, Mirrool.
Florence	Manager, Experiment Farm, Glen Innes.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Bathurst.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
Hard Federation	Manager, Experiment Farm, Bathurst.
	H. M. Hall and Sons, Studbrook, Cunningar.
	N. Campbell, Glasleck, Curlewis.
Improved Steinwedel	Manager, Experiment Farm, Temora.
Major	Manager, Experiment Farm, Temora.
	Hughston Bros., Hughstonia.
Marshall's No. 3	Manager, Experiment Farm, Bathurst.
	Hobson Bros., Glenlea, Cunningar.
	S. Reilley, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	A. J. Rial, Wolseley Park.
Penny	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Rymer	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Thew	H. M. Hall and Sons, Studbrook, Cunningar.
Union	Manager, Experiment Farm, Temora.

Wheat—continued.

Warden	Manager, Experiment Farm, Bathurst.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Cornish Bros., Sooble, Whylandra, *via* Dubbo.
	Hughston Bros., Hughstonia.
	B. J. Stocks, Linden Hills, Cunningar.
Yandilla King	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Hobson Bros., Glenlea, Cunningar.
	Hughston Bros., Hughstonia.
	E. Idiens, Boorowa.
	A. J. Rial, Wolseley Park.
	Hannett Bros. and Wilson, Wellville, Cunningar.
Yandilla King (ungraded) ...	W. V. Herbert, Bongalong, Muttama.
Oats:—	
Algerian	Gollasch Bros., Pine Park, Milbrulong.
Guyra	Manager, Experiment Farm, Glen Innes.
Lachlan	Manager, Experiment Farm, Bathurst.
Mulga	Manager, Experiment Farm, Glen Innes.
Sunrise	Gollasch Bros., Pine Park, Milbrulong.
White Tartarian	Manager, Experiment Farm, Glen Innes.
	J. S. Whan, Llangothlin.
Yarran	Manager, Experiment Farm, Bathurst.
Barley:—	
Chevalier	A. J. Rial, Wolseley Park.
Kinver	Manager, Experiment Farm, Temora.
Pryor	Manager, Experiment Farm, Temora.
Trabut	A. J. Rial, Wolseley Park.
Lucerne:—	
	W. E. Myring and Son, Pallamallawa.
Tick Beans:—	
	D. Cameron, Mount George.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

How to Dry Figs.

Figs for drying should be thoroughly ripe, the fruit being left on the tree until it bends over on its stem and feels soft and flabby to the touch. Before being subjected to the actual drying process, the figs should be dipped in a weak caustic solution, made by dissolving about 1 lb. of caustic soda in 20 gallons of water. The period of immersion should not be more than about 3 seconds. The fruit should then be removed, allowed to drain, and placed on wooden trays.

If a bright colour is desired the fruit should be treated with sulphur fumes. A simple method of fumigation is to obtain a wooden case large enough to fit over the trays of figs when stacked. Place the trays one on top of another on the ground, making sure that air can circulate freely around each tray and that the fruit is not crushed, and cover the whole with the inverted case. Tunnel an entrance beneath the box, place in this hole an iron jar containing burning sulphur, and allow the fumes to be generated for about 30 minutes. If there are cracks in the box, a bag or some other covering should be thrown over it to prevent leakage of the fumes. Drying, provided that the heat of the sun is not too intense, should immediately follow this sulphuring.—W. J. Allen.

Orchard Notes.

May.

W. J. ALLEN and S. A. HOGG.

Preparation of Land for Planting.

Where possible it is an advantage to prepare land selected for the planting of an orchard or vineyard some twelve months in advance. This early treatment allows the soil to become sweetened, and conserves moisture for the use of the plants the following year.

Although subsoiling is rather a costly operation it is strongly recommended where the planting of either vines or fruit trees is intended. Care should be taken in subsoiling to prevent the mixing of the surface and subsoils as, generally speaking, it has been found that when these soils are mixed the growth of the plants is not so vigorous. Of course there are exceptions; for instance, on the Murrumbidgee Irrigation Areas it has been found an advantage to plough to a depth of even 18 to 30 inches, thereby thoroughly mixing the soil and subsoil. However, on portions of these areas there is a clay band at a depth of from seven to ten inches below the surface, and underlying this a friable loam which at some distant period may have been surface soil.

Laying out an Orchard.

In laying-out the orchard there are several systems of placing the trees in the rows. The most commonly used is the square method, although during recent years a few orchards have been laid out on the equilateral or septuple system.

One mistake commonly made in laying-out an orchard is that no provision is made for the headlands and roadways which will later on be required for carting fruit, manure, etc. Another frequent mistake is the planting of the trees too close together. There cannot be any hard and fast rules as to the distance trees should be planted apart, for it is found that soils and rainfalls vary to such an extent that the intending planter must be governed by the local conditions.

Selection of Varieties.

The selection of kinds for planting should be most carefully considered, and for this purpose growers should select such varieties as will thrive best in the district in which they intend planting, and plant each species and variety in the position best suited to it. As a further guide to the selection of varieties, the intending planter should make a careful inspection of the fruit markets, and enquire from fruit merchants concerning the varieties which are considered the most profitable for the markets it is intended to supply.

It is thought by many amateurs that the planting of a tree which is several years old is an advantage, and that fruit will be secured in a shorter time. This, to some extent, is correct, but when trees have attained the age of three years from budding, especially in the nursery, they will be severely checked upon removal, and, generally speaking, they only recover where special attention is given to removing them. With a view, therefore, of establishing the trees permanently, only young trees should be selected With such kinds of fruit as apricots, peaches, nectarines, plums, and cherries, one-year-old trees should be planted, but two-year-old apple and pear trees may be used, though one-year-old trees are preferable.

Fruit-fly.

In districts where fruit-fly infestation has occurred a careful watch should be kept on all citrus fruits, and steps taken to prevent the likelihood of serious infestation.

Woolly Aphis.

At this season of the year, as the leaves are falling, it is a good plan to spray any trees affected with woolly aphis; for this purpose a nicotine spray is most suitable. If the leaves have quite fallen from the trees, a miscible red oil may be applied.

Harvesting.

Lemons and mandarins will soon be ready for picking. It is essential, in handling these fruits for market, to see that they are well graded and well packed. Most of the late apples and pears will have been harvested and placed away for keeping. It is a good plan to inspect the fruit regularly, and remove any decayed or bad specimens. Passion-fruit will now be ready for market; the fruit should be regularly pulled as soon as it reaches a uniform black colour. To pack the fruit well it is most necessary to have it well graded.

Drying of Prunes, Currants, and Sultanas.

An article appeared in the *Gazette* for February last on the drying of prunes, currants, and sultanas, in which the time for the second dipping of prunes, under the heading, "Re-dipping and Drying," was stated as seconds instead of minutes. This portion of the article should have read: "The time of the immersion is again governed by the condition of the fruit; if it has become dry it requires from one to two minutes in the dipping basket or from three to five minutes in the bag.

To prepare the ground for a lawn, plough or break it up with a mattock to the depth of 9 inches. Harrow or rake the surface before levelling or grading and roll thoroughly before planting or sowing. As the grasses grow the surface should be rolled regularly, and too much growth should not be allowed before cutting, or a thin bottom will be created. This note applies to pleasure lawns only, not to playing areas such as bowling greens and tennis courts.—E. N. Ward, Superintendent, Botanic Gardens.

The Removal of an Undesirable Flavour and Aroma from Honey.

W. A. GOODACRE, Senior Apiary Instructor.

DURING the past season a fairly large quantity of honey that contained a very undesirable flavour and aroma was extracted from the hives at the Government apiary at Wauchope. The other qualities of the honey, such as its colour and density, were of a high standard. It was observed that the tree commonly called turpentine and a number of other shrub plants were flowering at the time.

The matter was brought under the notice of the Department, and put into the hands of Mr. A. A. Ramsay, Principal Assistant Chemist, for experiment as to the possibility of treatment that would remove the defects.

Two methods were devised in the laboratory by Mr. Ramsay, by which both the undesirable quantities were removed from the small samples submitted, and a trial on a commercial scale on the same lines was decided on.

The following is a description of the methods employed :—

Animal Charcoal Treatment.

Thirty ounces of animal charcoal were thoroughly mixed into 50 lb. of slightly-warmed honey, and the mixture stirred occasionally and left for a period of twelve hours. An ordinary cappings reducer—a water-jacketed arrangement, having diamond-shaped hot water pipes fitted low down in the inside—was fitted up with a piece of wet flannel as a filter, so that the flannel would have the support in the straining of a piece of wire cloth screen placed over the hot water pipes, and so that the flannel completely covered the inside of the reducer.

The heater was filled with hot water and kept at a temperature of 150 degrees Fah. by a heater placed underneath in the usual way. The warmed mixture of honey and animal charcoal was then poured into the body of the apparatus, and within a few moments the water was delivered from the filter, and the honey commenced to flow steadily but freely. The time occupied in filtering the honey was forty minutes.

The honey came through perfectly clear, and the change in both flavour and aroma was remarkable. The harsh flavour and peculiar aroma had completely disappeared, and yet the good qualities of the honey had not been interfered with. The honey had been changed from a very unpalatable sample to a high grade one.

The honey should be allowed to run straight from the reducer as it filters through the flannel. The idea of wetting the flannel previous to placing it in the funnel is that the warmed honey will filter easier, and the water with which the flannel is impregnated will be displaced by the honey as it enters the flannel. If desired, the water could be put away and the receiver placed in position as the honey commences to come through. The amount of water is very small, and does not appreciably alter the composition of the honey. With imperfect filtration no harmful result would obtain so far as human consumption is concerned, but the honey would be cloudy and unattractive.

The animal charcoal can be used more than once. Our procedure was to put the used charcoal in a feeder over a good colony, and to allow the bees to clean it up while a fresh lot was being put through. Of course, there must be surety of freedom from disease in all cases where honey is fed to bees. There may be some difficulty at the present time in obtaining supplies of suitable animal charcoal. Fine-grained charcoal is usually available from chemists, but it is imperative that a coarse-grained charcoal be used.

The Alumina Cream Method.

The second treatment consisted of mixing alumina cream with the honey at the rate of 1 oz. of the cream to 1 lb. of the honey, allowing the mixture to stand for fifteen to thirty minutes, and then filtering as above. The result obtained, so far as the removal of the harsh flavour and peculiar aroma was concerned, were equal to that of the animal charcoal method, but trouble was experienced in the filtration of larger quantities. After 30 lb. of honey had been filtered the flannel became congested with cream. Further experiments to remove this trouble will be carried out.

The Department would be pleased to receive for experimental purposes samples of honey of undesirable flavour from different parts of the State.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
Corowa P. A. and H. Society	... J. D. Fraser ...	Aug. 21, 22
Grenfell P. A. and H. Association	... G. Cousins ...	,, 28, 29
Murrumbidgee P. and A. Association (Wagga)	... F. H Croaker ...	,, 28, 29, 30
Culcairn P. A. H. and I. Society	... L. H. M. Newton .	Sept 4, 5
Barmedman A. and H. Society...	... A. J. Meagher ...	,, 5
Young P. and A. Association	.. T. A. Tester ...	,, 4, 5, 6
Junee P. A. and I. Association	... T. C. Humphrys ..	,, 6, 7
Cowra P. A. and H. Association . ..	... E. P. Todhunter...	,, 11, 12
Cootamundra A. P. H. and I. Association ...	... W. W. Brunton...	,, 11, 12
Gunnedah P. A. and H. Association	... M. C. Tweedie ...	,, 11, 12, 13
Holbrook P. A. and H. Society...	... J. S. Stewart ...	,, 18, 19
Ganmain A. and P. Association	... T. S. Henderson...	,, 18, 19
Canowindra P. A. and H. Association ...	... J. T. Rule ...	,, 18, 19
Temora P A. H. and I. Association	... A. D. Ness ...	,, 18, 19, 20
Boorowa P. A. and H. Association	... W. Burns... ...	,, 20, 21
Northern A. Association (Singleton)	... J. T. McMahon ...	,, 20, 21, 22
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West Wyalong P. A. H. and I. Association ...	... T. A. Smith ...	,, 25, 26, 27
Koorawatha A. Society	... J. A. Larson ...	Oct. 2
Ardlethan A. Society	... R. Neill	,, 3
Narrandera P. and A. Association	... W. H. Canton ...	,, 4, 5
Ariah Park A. Society	... J. F. McInnes ...	,, 10
Lismore A. and I. Society	... H Pritchard ...	Nov. 20, 21, 22

[Subsequent fixtures are noted but held over.]

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Agricultural Gazette of New South Wales.

Some Aspects of the Wheat Rust Problem.

WALTER L. WATERHOUSE, University of Sydney.

A DETAILED knowledge of the causal agent is usually an essential to the successful control of a plant disease. In this article it is proposed briefly to set out some of the known facts concerning the fungi which cause rust in wheat.

There are three distinct organisms which cause three distinct kinds of wheat rust. The two least important, from the Australian point of view, will be dealt with first.

Yellow Stripe Rust.

Yellow stripe rust is caused by a fungus known as *Puccinia glumarum*. As far as is known this rust does not occur in Australia. In Europe it is extremely common, and does great damage It was unknown in the United States of America until about eight years ago, when a visiting Danish scientist first noted its occurrence on wheat. But when collections in herbariums came to be examined it was found that the yellow stripe rust had been collected from certain areas in the United States over twenty years previously; these specimens had been wrongly determined as leaf rust, next to be described. It would be well for us to continue to be on the look-out for yellow stripe rust in Australia. Work carried out in Europe and the United States has shown that wheats of the Federation type are very susceptible to this rust.

The rust occurs on the leaf blades as yellow stripes, parallel to the length of the leaf. The stripes of rust follow the course of the veins. On the fully grown plant, the rust occurs commonly on the glumes or chaff of the ear - a fact which gives the rust its specific name.

In England the ravages of yellow stripe rust were responsible for a decreased yield of 10 per cent. of the crop when the damage was reckoned over a number of seasons To combat these attacks, classical wheat-breeding work has been carried out by Professor Biffen, of Cambridge. Leaving out of consideration, for the present, numerous very important results affecting flour quality, the result of his work has been the production of varieties of wheat that have all the valuable high-yielding characteristics of the old English varieties, and in addition, the quality of being resistant to the rust fungus. It is interesting to note that such a resistant variety gives a yield which, over a series of years, is 10 per cent. higher than the yield obtained from the old susceptible type of wheat. In other words, the ravages of the yellow stripe rust have been eliminated. This extraordinarily valuable breeding work has given a great stimulus to plant-breeders throughout the world.

A

Spring Rust, Leaf Rust, or Brown Rust.

The fungus causing this trouble is named *Puccinia triticina*. The common names given above indicate some of the striking characters of the disease. In Australia it occurs in the spring, and is almost entirely restricted to the leaves, upon the upper surfaces of which it causes yellowish-brown, scattered rust spots.

It is generally thought that this fungus causes no loss in our crops, although its presence is usual. In the United States of America, however, in 1919, estimates of the loss based on careful field surveys, were set down at 16½ million bushels of grain. Further, in an interesting study of some of the effects which this fungus has upon the wheat plant, an American investigator has shown that where only 1 per cent. of the area of the leaf was occupied by the rust spots, the amount of water transpired by that plant was increased by 38 per cent. In the light of these results it is likely that the leaf rust actually does considerable damage under our conditions where water supply for the plant is usually the limiting factor.

From the fact that some varieties are known which are strongly resistant to leaf rust, it should be possible to breed varieties having the valuable qualities of, say, Federation, and, at the same time, the quality of resistance. Studies in the United States have shown that specialisation—a phenomenon that will be referred to in connection with stem rust—occurs to a limited extent in leaf rust. In a number of tests of our Australian leaf rust no specialisation has yet been found. Probably, then, the breeding problem would not be a very difficult one.

Summer Rust, Stem Rust, or Black Stem Rust.

The fungus which causes this disease is called *Puccinia graminis*. The rust is the one which causes such great damage to our wheat in certain years. Detailed figures from the United States and Canada show that in 1916 this rust was responsible for the loss of one-third of the wheat crop, amounting to some 300,000,000 bushels of grain. In 1920, in the one State of Minnesota, 60 per cent. of the crop, or 25,000,000 bushels, were estimated to have been destroyed by the rust. Rust has become a limiting factor in wheat production in these parts. In New South Wales the loss from stem rust in 1916 is computed by Mr. A. H. E. McDonald, Chief Inspector of Agriculture, to have exceeded £2,000,000. This was a bad epidemic year, when the prevailing weather conditions were particularly favourable to the fungus. But in normal seasons the rust is generally present in the crop, and takes its toll.

General Characteristics.

This rust appears later in the season than the leaf rust; usually it is not observed until the commencement of summer. It attacks all parts of the plant, but is particularly bad on the stems. Here it causes long, reddish patches, round the edges of which the ruptured epidermis is to be seen. As summer advances and the plants mature, these red patches change to black, owing to the fungus inside the plant producing black instead of red spores.

It is from these black spores that the bodies arise, which in the following spring produce the rust on barberry bushes. It used to be thought that this "barberry stage" of the fungus could not be produced by the Australian stem rust, but we know now that, at least under some conditions, the Australian rust can bring about this infection. For this reason it has been urged that the distribution of the barberry should be discontinued. In the United States this shrub plays a most important part in spreading the rust, and large sums of money are spent each year in the attempt to eradicate the plant. In our present consideration we entirely leave out this stage on the barberry and deal only with the occurrence on wheat.

Specialisation of Stem Rust.

At the outset it must be clearly understood that wheat is not the only cereal attacked by stem rust. The fungus known as *Puccinia graminis* occurs on wheat, oats, barley, rye, and a large number of grasses, both native and introduced. It is of the utmost importance to know whether these plants all harbour the same parasite. Putting it in another way—can the stem rust on oats, for example, attack wheat?

European studies showed the existence of one stem rust on oats, a different one on rye, and yet another on wheat and barley; in addition to these there were several on certain grasses. United States workers have obtained substantially similar results. Omitting the rusts on grasses, there are, then, three distinct races of stem rust which occur on cereals. The race on oats attacks only that cereal. The race on rye can also affect barley. The race on wheat attacks barley, and, to a lesser degree, rye, but cannot infect oats. This last-mentioned fact was made use of in some small-scale experiments at Hawkesbury Agricultural College, where Federation wheat and Algerian oats were sown in alternate drills. At maturity there was less rust on this Federation than on Federation sown close by in the usual way with the drill. Remembering, then, that there are several stem rusts, we proceed to deal a little more fully with the one which occurs on wheat.

Specialisation of Stem Rust on Wheat.

As studies of wheat rust proceeded it was found that some varieties of wheat were susceptible, whilst others grown under the same conditions were resistant to the fungus. It is worth seeing what is involved in these reactions of the host plant, referred to as "susceptibility" and "resistance." In the case of a susceptible wheat, a red spore of the rust which falls on it germinates under favourable conditions and enters the plant. Here the fungus establishes itself, living upon the plant food material that is being elaborated by the cells of the wheat plant. It is important to note that the food of the fungus is the product of the living cells. These latter continue to function in spite of the presence of the parasite. Growth of the rust fungus goes on, and after about ten days it commences the production of fresh crops of red spores. These fall and are blown about, serving to spread the rust to other wheat plants. Spore production goes on, crop after

crop being borne on the fungus body living inside the host plant. Of necessity the latter suffers from the loss of all this foodstuff which ought to have gone to the production of grain or other plant parts. In extreme cases the wheat plant dies; if grain is produced it is pinched.

In the case of a resistant plant events are different. The spore germinates on the surface, and the fungus enters the plant just as in the case of the susceptible plant. The fungus body begins to develop, but gets no further than the beginning. For some reason the fungus cannot establish itself. At these spots where the fungus has penetrated the plant, the resistant leaf, or other plant parts, shows evidence of the attack by the presence of small pale areas. In suitable preparations under the microscope, it can be seen that, as the fungus comes into contact with the living cells of the wheat plant, they are killed. Thus it is that pale areas, known as "flecks," appear on the resistant plant. The host in this instance cannot tolerate the presence of the parasite. The latter causes the death of the host cells, and in so doing, cuts off its source of food, which, it has already been stated, is derived from living cells only.

These are the extreme cases of susceptibility and resistance. Certain intermediate effects are well established. For example, some wheats are only fairly resistant; in these it is found that the fungus penetration does not immediately cause the death of the host cells in its vicinity, but it manages to eke out a precarious existence for a time, and actually produces a scanty crop of spores. But it soon dies. Obviously, in such a case comparatively little damage to the host ensues, and in addition, there are few spores available to be blown about and cause fresh infections.

There is a quality possessed by some wheats which must not be confused with rust-resistance. It is ability to *escape* rust attack. The exact factors concerned in this rust-escaping are not fully understood. Rapidity in maturing the grain after having come into ear is one important condition. But the point to emphasise is that these plants are not resistant. Such varieties escape serious attack under ordinary conditions, but if muggy weather prevails in the early summer they suffer. Our aim, then, should be to produce a resistant wheat rather than one which merely escapes attack—valuable as that character is.

This statement concerning susceptibility and resistance has been set out in order to clear the way for an understanding of the manner in which the specialisation of the wheat stem rust is determined. Our present knowledge of this all-important phase of the question is most largely due to Dr. E. C. Stakman, of Minnesota, and his co-workers. For many years they have been investigating the rust problem, and it is to the splendid work of this group of investigators that we owe most of our knowledge of the real nature and complexity of the rust problem. But in the light of this knowledge, they are pointing plainly to the sound method of attacking the problem, and it is likely that soon will come the announcement that they have produced a resistant wheat which is commercially satisfactory in every way. Biffen's success in eliminating damage from yellow stripe rust will then be repeated.

A variety of wheat very largely grown in northern United States is Marquis. In Kansas, United States, there is a well-known variety known as Kanred. Prior to 1917, Stakman found that Marquis was susceptible, while Kanred was resistant, to rust. Varying the conditions under which these varieties were grown did not make any difference to their reaction to the rust. Marquis was susceptible, Kanred was resistant. But in 1917, a stem rust of wheat was found to which Marquis was resistant and Kanred was susceptible. The two rusts appeared to be identical as regards size of spores, shape, colour, and so on; structurally they were similar. In their parasitic behaviour only they showed a difference. They were, therefore, said to be different biologic forms of the wheat stem rust. For convenience let us call the first A, and the second B. In order, then, to determine which biologic form an unknown rust belonged to, it was necessary merely to observe the reaction it gave when Marquis or Kanred was inoculated with it. Thus, if Marquis was used and a susceptible reaction shown, it belonged to A. If Marquis gave a resistant reaction, it was B. Similarly with Kanred. Either of these two varieties thus became a differential host for determining the biologic form of a rust.

About a year later another stem rust was found, to which both Marquis and Kanred were susceptible. The unusual parasitic nature of this rust showed at once that it was a new biologic form. Let us call this one C. Now, in dealing with an unknown rust it became necessary to grow it on both Marquis and Kanred, in order to determine which biologic form it was. Thus, if Marquis was susceptible and Kanred resistant, it was A; if Marquis was resistant and Kanred susceptible, it was B; if both were susceptible, it was C. Instead of having to use only one variety (*either* Marquis or Kanred), both varieties were necessary as differential hosts now that three biologic forms were known.

But certain other wheats, like Mindum, were still immune to the third biologic form. Nevertheless, further work led to the discovery of another biologic form to which Mindum was susceptible. Therefore, Mindum had to be used in addition to Marquis and Kanred in the identification of an unknown stem rust.

As work proceeded new biologic forms were discovered. After an exhaustive series of tests it was found that eleven varieties of wheat were required to sort out and determine the biologic forms occurring in the United States. That is to say, an unknown rust is grown on each of the selected eleven varieties, and the reaction it gives on each variety is carefully determined and tabulated. Thus, if we denote susceptibility by "S" and resistance by "R," one rust gives successively on the eleven hosts—

S, R, S, R, R, R, S, S, S, R, R;

another gives—

R, R, R, R, R, R, R, S, S, R, R;

yet another gives—

S, S, S, S, S, S, S, S, S, S, R;

and so on.

This systematic study of stem rusts from various sources has, to date, revealed the presence—not of a single race of wheat stem rust, as was formerly thought, but of thirty-seven biologic forms. So far every effort to alter the tabulated reactions by varying the environment of the host has failed. The resistance or susceptibility of a wheat to a particular biologic form is an inherent character of the plant. Similarly, the biologic forms appear to be constant. The occurrence of quite distinct biologic forms of wheat stem rust enables us fully to account for a number of otherwise obscure observations. For example, consider the case of Marquis. In one district it is susceptible, in another it is resistant. This is not due to any weather condition, cultural operation, or anything of that sort. It is solely due to the fact that the rusts in the two localities are different.

It is therefore clear that a knowledge of the parasitic behaviour of a rust in a particular locality should be determined. Then, by a comparison of results, the distribution of these biologic forms can be mapped In the United States it is now known that although there are thirty-seven distinct biologic forms, some are of limited distribution and of subsidiary importance. The important ones, which cause the heavy damage, are much more widespread and comparatively few in number.

Thanks to help from Dr. Stakman and his co-workers in the United States, and to numerous friends in Australia who are forwarding specimens of rust, this "spade-work" is well under way at the University of Sydney. Very definite biologic forms have been discovered, and their distribution is being determined. The more specimens there are available, the more thorough will this work be, and so it is that any samples sent in for determination will be gratefully received.

Breeding for Rust Resistance.

Brief reference has been made to Biffen's classical work dealing with yellow stripe rust. It so happened that the high-yielding and otherwise valuable commercial wheats were susceptible. Patient and exhaustive search brought to light varieties that were resistant; but these were of only the slightest commercial value. Next, breeding experiments proved that the character of being resistant is transmitted in heredity as a unit character. There are certain complications, well recognised by genetical workers, but it is possible to breed a valuable commercial wheat which is also resistant. The character of resistance is added to the other characters which go to make the wheat commercially valuable.

The solution of our rust problem is to be sought along these lines. Our commercial varieties of wheat are nearly all susceptible to rust. What is wanted is to add to their desirable characters—like good colour, high quality, and heavy yield—the ability to resist rust. The first thing is to find a wheat which is resistant, and it is in this connection that a full knowledge of our biologic forms is so necessary. Obviously, the ideal parent for the breeding work would be a wheat which is resistant to every biologic form that occurs. Failing this, we must use one which is resistant to the important biologic forms which cause most of the damage.

Working on such a scheme, and carrying out rigid selection, the American workers have produced, and will shortly make available to farmers, such a "synthetic" wheat. It has all the valuable characteristics of Marquis, and, in addition, the ability to resist the commonly-occurring biologic forms of the rust.

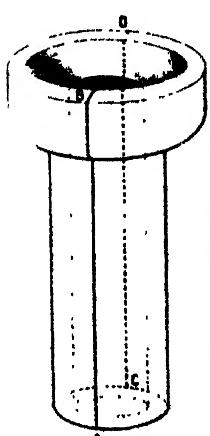
Conclusion.

The studies which are in progress in Sydney are yet far from complete, but they are sufficient to indicate certain wheats as resistant to every biologic form so far encountered in Australia. Commercial wheats like Federation have been crossed with them. There remains the difficult task of selecting the right types of commercial value, which, after testing, are found to be resistant. In view of the results obtained abroad, there is every probability that the solution to the problem will ultimately be found.

THIS MONTH'S BUREAU CONFERENCE.

BY the time this number of the *Gazette* reaches the farmer the State Conference of branches of the Agricultural Bureau at Hawesbury Agricultural College will be close at hand. Much important business will be dealt with during the five days' proceedings (18th to 22nd June). The conference will be opened by His Excellency the Governor (Sir Walter Davidson). Some 120 motions are down for discussion, and a large attendance of delegates and others is anticipated.

TO HALVE AN EARTHENWARE DRAIN PIPE.



A SIMPLE method of halving a glazed earthenware drain pipe recently came under my notice.

The pipe is stood in a vertical position with the funnel end uppermost, and filled with dry earth or sand, which is lightly rammed down. It is then struck a succession of medium blows one or two inches apart according to the thickness of the pipe walls, with a light hammer in an ascending direction along opposite sides, for its full length (along the lines AB and CD in the accompanying illustration), taking care to strike more lightly at the wide end, where the earth is loose. When the point D is reached, the pipe should fall apart; if it does not, then the blows struck were not heavy enough. The break will follow the lines where the blows were struck. The whole operation can be completed in a few moments.

It must be emphasised that the break is caused entirely by the pipe being struck with a hammer. If an empty pipe were struck it would be shattered, but because of the resistance offered by the sand or earth the pipe splits open in a somewhat similar manner to a log split by wedges driven by a maul.—P. WALLER, Dairy Instructor.

The Success of Elephant Grass in the Recent Dry Season.

J. N. WHITTET, Agrostologist.

ELEPHANT GRASS (*Pennisetum purpureum*) is a rapid grower that comes away early in the spring, and if it is eaten off or cut and fed to stock before it becomes too coarse, it provides a large amount of succulent feed. The best time to use it is when it is about 2 feet high. The amount of growth made by Elephant grass in a number of districts on the very limited rainfall of the recent dry season was remarkable, and is worthy of being recorded.

At Hawkesbury Agricultural College.

Observations made at Hawkesbury Agricultural College, Richmond, showed that although the season was a particularly trying one, the grass proved its ability to produce fodder under conditions far from favourable to plant growth. From 1st August, 1922, to 28th February, 1923, only 7·94 inches of rain fell, whereas the average annual rainfall for the Richmond district is approximately 30 inches.

An acre-paddock of Elephant grass, planted in March, 1919, with plants 3 feet apart each way in the field, was used for pasture for milking cows during the period, August to February, whenever there was sufficient growth on the area. The grass was allowed to attain a height of from 18 inches to 2 feet before the cows were turned in on it. The fodder, at this stage, was soft and palatable, and relished by the stock. After the morning milking the cows were put in the paddock and left there until about 2 p.m., just prior to the afternoon milking. At night they were pastured in one of the larger paddocks.

Under these conditions the acre of Elephant grass made sufficient growth to allow of the cows being turned in on it three times during the seven months, each feeding period lasting a little over a week. Twenty-five cows were pastured on this area on the first two occasions, and fifty-three on the last, and by the 23rd March the paddock could be used again.

Elephant grass thus showed itself to be of great value for cattle feed on the poor land in this district during a dry, unfavourable season; it maintained and in some cases, increased the milk flow. Adjoining paddocks of lucerne made hardly any growth during the period.

On the North Coast.

At Wollongbar Experiment Farm, near Lismore, two acres were planted with Elephant grass for pasture purposes some four years ago, but owing to an abundance of feed being available, very little use was made of the

Fig. 1.—Elephant Grass at Hawkesbury Agricultural College before being eaten off.

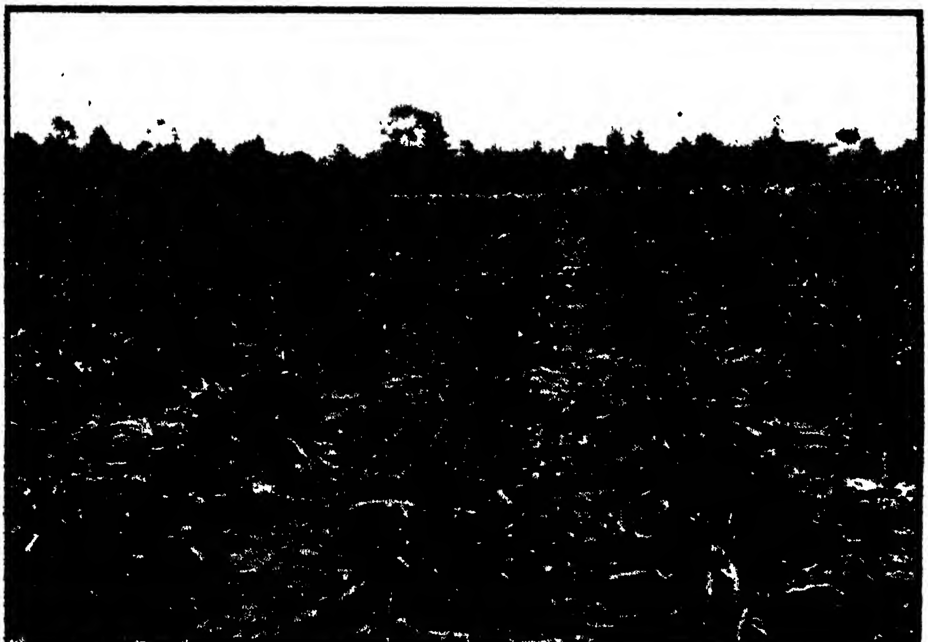


Fig. 2.—The same plot as in Fig 1—after being eaten off.

plot until the season under review, and the grass was allowed to grow to its maximum height of about 12 feet each year. At this stage of growth cattle simply pick the lower leaves off the stems, and the growth affords a certain amount of shelter for the stock during winter months. In September, 1922, however, the heavy top growth was cut with brush hooks, and the trash and stems left on the ground. This provided an excellent mulch, and when tramped in by stock added humus to the soil. The young growth came away very rapidly, and although repeatedly stocked, this vigorous growth continued right through the dry period. The paddock was the only green patch on the farm.

It was estimated that the carrying capacity of this grass right through the dry time was easily a beast to the acre. This test proved conclusively that Elephant grass does well in the Richmond River district, in spite of continuous dry weather.

In addition to this evidence from Government farms, numerous reports have been received from coastal farmers, in which it was stated that Elephant grass had proved very useful in providing green feed during the exceptionally dry period experienced, and in all cases it was mentioned that it was intended to sow an increased area to Elephant grass during the coming spring.

In the West.

The rainfall at Cowra Experiment Farm for the seven months period, September, 1922, to March, 1923, inclusive, was 7·75 inches, 4·2 inches of which fell in December. In spite of this fact, the plot of Elephant grass made good growth right through the dry spell, and cattle were turned in on it after the evening milkings for the periods 23rd January, 1923, to 19th February, and 7th March to 16th March. Up to the last feeding-off the grass had attained an average height of 3 feet, and at the end of March exhibited a growth of 9 inches, notwithstanding the fact that only 20 points of rain fell during the months of February and March.

A Harvest that Never Ends.

There is no month in the year during which the wheat harvest is not being carried on in some part of the world. This is indicated as follows:—*January:* Australia, New Zealand, Argentina, Chile. *February:* India. *March:* India, Upper Egypt. *April:* India, Persia, Asia Minor, Lower Egypt, Mexico, Cuba. *May:* Japan, China, Central Asia, Morocco, Algeria, Tunis, Texas. *June:* South of France, Spain, Italy, Greece, Turkey, Japan, United States (south of 40 degrees). *July:* France, Germany, Austria, Hungary, Roumania, Bulgaria, Southern Russia, Canada, Northern United States. *August:* England, North of France, Belgium, Holland, Central Russia, Canada, United States. *September:* Scotland, Sweden, Norway, Canada. *October:* Northern Russia, Finland. *November:* South Africa, Argentina, Peru. *December:* Burma, Australia, Argentina.—*International Review of the Science and Practice of Agriculture.*

The Proportion of Grain to Straw in Wheat Varieties.

J. T. PRIDHAM, Plant Breeder.

THE conditions obtaining at Cowra Experiment Farm last season were favourable for the determination of the power possessed by different varieties of wheat to make the best use of a limited rainfall, the registration for May to November, inclusive, the period over which the crops occupied the land, being only 977 points.

At Cowra Farm all the most prominent varieties in cultivation in this and neighbouring States are grown in small plots in triplicate, with a variety of wheat or oats sown in alternate plots throughout, in order to provide uniform conditions of growth as far as possible. In this way the yields of varieties are not affected as they would be by having an early or late sort adjacent, all being sown alongside the same buffer variety. Mice affected the germination in some plots last season, but on the whole the results were the most uniform obtained for some years. The plots were cut by hand, leaving a uniform length of stubble for convenience. The migration ratio cannot therefore be given, as the entire plant was not handled. The proportion of grain to sheaf will provide, however, a sufficient guide to the character of the varieties with regard to utilisation of soil moisture.

Table I shows the ratio of grain to sheaf, and other details of the varieties grown last season on the triplicate series of plots.

Table II is included to show some semi-solid straw South Australian wheats. Waratah is also of this character. Although these varieties have not a high ratio of grain to sheaf, they are good general purpose sorts.

Table III shows some of last season's figures in conjunction with those for the same varieties on similar plots in 1915, when the useful rainfall was 1,529 points, and in 1914, when it amounted to only 928 points. In Table I the ratio of grain to sheaf was arrived at by dividing the yield of grain by the weight of the sheaf. In Table III the ratio for Hard Federation for last season is given as ·315. This was the average of a number of plots (Hard Federation being the check variety in the tests), and the figure is more reliable than that given in Table I. The gaps in Table III are due to the fact that new varieties are continually being tested, and if after three years in the plots they are found unpromising they are rejected.

The selections from Hard Federation 35 (C1), also Cowra Nos. 31 and 32, are all the result of a natural cross between this variety and Marshall's No. 3.

This is a very promising wheat with a large brown ear. Narrogin No. 8 (Federation x Huguenot) stands high in Table I, but has not given consistently high yields over a series of years. Hoof's Imperial is a selection from Federation, and Onas a cross between that variety and Tarragon made by Mr. Coleman, of South Australia. Ghurka is a cross between Indian and Yandilla King. It will thus be seen that Federation, Marshall's No. 3, and Yandilla King have the faculty of making the best use of the rainfall.

Looking down the list, one notes that Clarendon, Warden, and Zealand are strawy wheats The value of Clarendon seems to lie chiefly in its ability to give a crop of grain in a rusty season, and the other two are essentially hay wheats, though Warden may perhaps be considered a general purpose variety.

It is unfortunate that there was not a plot of Ghurka under comparable conditions in 1915, this wheat has a very high ratio of grain to sheaf, and we have crossed it with Steinwedel, which should be a good combination. Blue Wave is a selection from Federation, and Reilly's a cross between Federation and Currawa.

TABLE I.—Showing Details, including Proportion of Grain to Sheaf, of Varieties in Plots sown in triplicate on 9th May, 1922.

Variety	Date Ears Peeping	No Plants Harvested	Gross Yield	Yield of Grain	Ratio of Grain to Sheaf
			oz	oz.	
Narrogin No 8	25 Sept	57	60	26·5	441
Cowra No. 31	25 ,,	79	97	42·5	438
Ghurka	18 ,,	99	124	52 5	·423
Onas ...	30 ,,	102	124	52 5	423
From Hard Fed. 35 (Cl) A	21 ,,	95	135	55 2	409
From (Marshall's No 3 x W B)	18 ,,	102	129	52 5	407
Indian Fife x Federation	27 ,,	93	123	49	·398
Canberra	27 ,,	109	132	52 5	397
From Hard Fed. 35 (Cl) B ..	29 ,,	96	144	57	·395
Hoof's Imperial	5 Oct	117	130	51	392
HBS x Zaff x Wallace	25 Sept.	95	132	51	·386
From Yandilla King A	27 ,,	93	126	48·5	·384
Aussie	25 ,,	108	112	43	·383
Yuna	3 Oct.	95	118	45·2	·381
Union	30 Sept	113	143	54 2	·379
From Hard Fed. 13 (Cl) A	27 ,,	103	136	51·5	·378
Silver Baart	25 ,,	91	127	48	378
Ross's ...	3 Oct	109	122	46	·377
Dreadnought &c., A	15 Sept.	75	121	45	·371
Hard Fed. x Cleveland A	28 ,,	121	164	61	·371
Newman's Early . ..	27 ,,	106	128	47	·367
From Hard Fed 35 (Cl) C	3 Oct.	108	160	58·5	·365
Bobs x Federation	28 Sept.	86	129	47	·364
From Hard Fed. 13 (Cl) B	27 ,,	100	143	52	·363
Waratah	23 ,,	122	151	54	·357

TABLE I.—Showing details, including Proportion of Grain to Sheaf, of Varieties in Plots sown in triplicate on 9th May, 1922—*continued.*

Variety.	Date Ears Peeping.	No. Plants Harvested.	Gross Yield.	Yield of Grain.	Ratio of Grain to Sheaf.
			oz.	oz.	
Gluyas	24 Sept....	116	134	47·7	·356
Triumph	2 Oct. ...	83	118	42	·356
Roseworthy	9 ,, ...	89	118	42	·356
From Hard Fed. 35 (C1) D ..	4 ,, ..	96	138	49	·355
Gresley	25 Sept. .	94	132	46·5	·352
Dreadnought &c., B	7 Oct. ..	96	118	41·5	·351
Hard Federation	19 ,, ..	115	162	56·7	·350
Purple Straw	9 Oct. ..	85	120	42	·350
Ford	3 ,, ...	88	123	42·5	·345
From Hard Fed. 29 (C 1) ...	30 Sept...	89	113	39	·345
Hard Fed. x Cleveland B ...	27 ,, ..	102	149	51·5	·345
From Yandilla King B	30 ,, ..	81	119	41	·344
Bathurst No. 10	5 Oct. ..	96	127	43·5	·342
Wandilla	3 ,, ..	98	143	48·5	·339
Dreadnought &c., C	7 ,, ..	105	141	47·7	·338
From Yandilla King C	23 Sept...	110	152	51·5	·338
From Waratah A	3 Oct. ..	119	145	49	·337
Reilly's	30 Sept...	91	128	43·2	·337
Hard Fed. x Cleveland C ..	25 ,, .	103	14[illegible]	47	·335
Flamen	3 Oct. ..	77	112	37·5	·334
Blue Wave...	2 ,, ..	113	152	50·7	·334
Cowra No. 30	25 Sept. .	105	126	42	·333
Dollar	3 Oct. ..	87	108	36	·333
Red Russian	3 ,, .	78	86	28·5	·331
Graham	9 ,, ...	78	113	37	·327
Cowra No. 36	13 Sept....	105	142	46·5	·327
Bathurst No. 17	8 Oct. ...	105	162	53	·327
From Hard Fed. 43 (610) ...	27 Sept...	102	124	40·5	·326
From Waratah B	3 Oct. .	101	144	47	·326
Cowra No. 15 x Cowra No. 19 ...	27 Sept...	112	130	42	·323
Cowra No. 32	3 Oct. .	100	124	40	·322
Wilfred	27 Sept. .	84	112	36	·321
Dreadnought &c., D	27 ,, ..	71	100	32	·320
Cowra No. 28	23 ,,	106	—	57	—
From Yandilla King D	25 ,, ..	117	150	48	·320
Sands	19 ,, ..	90	138	44	·318
Queen Fan	9 Oct. .	107	130	41	·315
From Hard Fed. 35 (C 1) E ..	8 ,,	100	148	46	·310
Bayah	2 ,, ..	104	140	43·5	·310
From Waratah C	29 Sept....	101	131	40·5	·309
Warden	11 Oct. ..	110	158	48·7	·308
From Hard Fed. 71 (86)	3 ,, ..	97	163	50·2	·308
Bathurst No. 9	9 ,, ..	120	156	47·5	·304
Exquisite	9 ,, ..	102	149	45	·302
Archer's	2 ,, ..	123	142	43	·302
Boureong x Cowra No. 19 ..	30 Sept....	111	152	46	·302
Nyngan No. 3	19 ,, ...	114	146	43·5	·298
Hard Fed. x Cleveland D ...	7 Oct. ..	111	156	46·5	·298
Clarendon	19 Sept....	104	128	37·5	·293
Hard Federation	19 ,, ...	105	147	43·5	·292
Warren-Clarendon cross... ...	28 ,, ..	109	152	43	·282
Hard Fed. x Cleveland E ...	30 ,, ...	113	157	40·5	·256
Rymer	7 Oct. ...	96	92	23	·250

Table II.—Showing Details of Varieties sown in Single Plots.*

Variety.	Date Ears Peeping.	No. of Plants Harvested.	Gross Yield.	Yield of Grain.	Ratio of Grain to Sheaf.
			oz.	oz.	
Fortune	3 Oct.	33	52	17	·326
†Maharajah	30 Sept.	39	52	17	·326
†Rajah	30 ,,	40	60	18·5	·308
Hard Federation	27 ,,	41	72	22	·305
Fane	25 ,,	35	56	17	·303
Red Russian	3 Oct.	42	62	18·5	·298
†Emperor	23 Sept.	20	28	8	·285
†Sultan	23 ,,	37	53	15	·283
†Felix	21 ,,	29	50	14	·280
Cowra No. 29	2 Oct	..	35	13	·371
Warren	11 ,,	..	44	15	·340
†President	27 Sept.	..	42	14	·333
Steinwedel	3 Oct.	...	48	16	·333
Bald Knob	3 ,,	.	48	16	·333
Warrah	7 ,,	..	41	13	·317
Canaan	16 ,,	..	52	15·5	·298
Forge	18 ,,	...	40	10	·250

* The plots of Fortune, Maharajah, Rajah, Hard Federation, Fane, Red Russian, Emperor, Sultan, and Felix were sown on 8th May; the remainder on 22nd May. The plants in the second lot of sowings were not counted. † Indicates semi-solid straw.

Table III.—Showing proportion of Grain to Sheaf in the Seasons 1914, 1915, and 1922.

Variety.	Proportion of Grain to Sheaf. 1914.	1915.	1922.
Bunyip	·35	·383	...
Canberra	..	·365	·397
Bald Knob	..	·354	·333
Federation	·48	·342	..
Roseworthy	·44	·329	·356
Droophead	·36	·326	...
Thew	·40	·324	..
Warren	·33	·324	·340
Currawa	·41	·312	...
Gluyas	·40	·306	·356
Yandilla King	·41	·302	..
Purple Straw	·38	·301	·350
Marshall's No. 3	·49	·298	..
Bomen	·36	·296	...
Hard Federation	...	·290	·315
Newman's Early	.	·289	·367
Rymer	·41	·289	·250
Steinwedel	...	·288	·333
Cedar	·38	·276	...
Comeback	·33	·271	...
College Purple	·37	·268	..
Clarendon	·29	·267	·293
Avoca	·38	·265	...
Warden	...	·262	·308
Lotz	·34	·231	...
Zealand	·28	·204	...
Ghurka	·57	...	·423

Farmers' Experiment Plots.

Wheat, Oat and Barley Experiments, 1922.

Southern District.

G. C. SPARKS, Manager, Glen Innes Experiment Farm.*

The southern district cereal experiments of 1922 were located as under :—

G. Gow, "Hughenden," Barellan.
H. T. Manning, "Ravenstone," Barellan.
W. J. Martin, "Rotherwood," Barellan.
W. Thornton, "Spring Farm," Berrigan.
W. V. Herbert, Bongalong.
A. H. Jennings, "Urunga," Culcairn.
Hobson Bros., "Glenlee," Cunningar.
Carew Bros., "Selbourne," Deniliquin.
Eulenstein Bros., "Back Creek," Henty.
J. Busch, "Naradhun," Hillston.
W. T. Sargent, "Belleville," Hughstonia.
H. L. McInnes, "Pine Grove," Lake Cargelligo.
H. W. Belling, "Bexley," Lockhart.
H. Cheatley, Walliston, Mathoura.
R. McCrone & Son, "Bungambil," Mirrool.
P. Corcoran, "Weeroona," Moombooldool.
A. G. Jennings, North Berry Jerry.
H. M. Hall & Sons, "Studbrook," Cunningar.
Johns Bros., "Wollongough," Ungarie.
Smith Bros., "Rosedale Park," Yuluma, Urana.
J. T. Williams, "Forest Home," Wallendbeen.
D. and J. Gagie, "Spy Hill," West Wyalong.
R. H. Thackeray, "Woornack," Young.

Including the fallow experiment at Barellan, there were twenty-four experiments in the southern wheat belt in 1922, but as those at Deniliquin and Lake Cargelligo failed owing to drought conditions, only twenty-two came to harvest.

Culture Details.

Barellan (G. Gow).—Soil, dark; boree, gilgai country. July fallow; harrowed; disced September; springtoothed February; harrowed March. Sown (early) 18th April, (late) 25th May; seed, 48 lb. (early sown), 60 lb. (late sown); superphosphate, 52 and 60 lb. respectively (for early and late sowing) Rainfall—Fallow, 1,027 points; crop, 865 points.

Barellan (H. T. Manning).—Soil, heavy red loam. July-August fallow; left in rough until after harvest; harrowed December and February; spring-toothed April. Sown (early) 20th April, (late) 25th May; seed, 55 lb. (early sown) and 60 lb. (late sown); superphosphate, 50 lb. and 60 lb. respectively for early and late sowing. Rainfall—Fallow, 1,046 points; crop, 788 points.

* Late Senior Agricultural Instructor, Southern District.

Barellan (W. J. Martin).—Soil, light red loam. September fallow; harrowed October, January, and April; sown (early) 21st April, (late) 22nd May; seed 56 lb. and 60 lb., and superphosphate 42 lb. and 55 lb, respectively for early and late sowing. Rainfall—Fallow, 1,065 points; crop, 687 points.

Berrigan.—Soil, strong red loam. August fallow; disced September; rolled March; disced May; springtoothed and harrowed before sowing. Sown 20th May; seed, 58 lb.; superphosphate, 56 lb. Rainfall—Crop, 653 points.

Bongalong.—Soil, red loam. Ploughed May; harrowed twice before seeding. Sown 23rd May; seed, 56 lb.; superphosphate, 56 lb.

Culcairn.—Red loam August fallow; disced April; springtoothed May. Sown 18th May; seed, 60 lb. wheat, 50 lb. oats: superphosphate, 56 lb. Rainfall—Crop, 1,079 points.

Portion of Wheat Plots at Cunningar.

Cunningar.—Light loam. August fallow; harrowed October; springtoothed February and May. Sown 13th May; seed, 60 lb.; superphosphate, 56 lb

Henty.—Red loam. September fallow, disced March; scarified, harrowed, and packed prior to seeding. Sown 18th May; seed, 60 lb. wheat, 67 lb. oats; superphosphate, 55 lb. Rainfall—Fallow, 657 points; crop, 894 points.

Hillston.—Virgin red loam. July fallow; harrowed September; springtoothed October and May. Sown 5th June; seed, 50 lb.; superphosphate, 28 lb. Rainfall—Crop, 242 points.

Hughstonia.—Sandy loam. September fallow; disced March; harrowed April. Sown 2nd May; harrowed after drill. Seed, 58 lb.; superphosphate, 45 lb.

Lockhart.—Red clay loam. August fallow; springtoothed January to April; harrowed prior to seeding. Sown 19th May; seed, 56 lb.; superphosphate, 56 lb. Rainfall—Fallow, 762 points; crop, 751 points.

Mathoura.—Red clay loam. September fallow; disced January to April. Sown May; seed, 60 lb.; superphosphate, 56 lb.

Mirrool.—Red clay loam. September fallow; springtoothed October; disced in March; springtoothed and harrowed prior to sowing. Sown 24th April; seed, 50 lb.; superphosphate, 45 lb. Rainfall—Crop, 740 points

Moombooldool.—Sandy red loam (mallee). September (disc) fallow; disced February. Sown (early) 22nd April, (late) 28th May; seed, 56 lb. and 60 lb.

Another part of the Cunningar Plots.

respectively for early and late sowing; superphosphate, 56 lb. Rainfall—Fallow, 603 points; crop, 817 points.

North Berry Jerry.—Red clay loam. August fallow; unworked, except for springtoothing before drilling. Sown 3rd and 8th May; seed, 55 lb.; superphosphate, 60 lb.

Rocky Ponds.—Virgin, buff-coloured loam. August fallow; skim-ploughed in November; springtoothed in February, and skim-ploughed prior to seeding. Sown 15th May; seed, 60 lb.; superphosphate, 56 lb.

Ungarie.—Red loam. October fallow; springtoothed January, March, and May, and harrowed prior to seeding. Sown 17th May; seed, 56 lb.; superphosphate, 56 lb.

Urana.—Red loam. September fallow; springtoothed October, January, and April. Sown 30th May; seed, 55 lb.; superphosphate, 56 lb. Rainfall—Crop, 727 points.

Wallendbeen.—Sandy loam; old land. September fallow; disced in November; springtoothed in March, and skim-ploughed in May after rain, to check thick seeding of weeds; harrowed before drill. Sown 10th May; seed, 55 lb.; superphosphate, 56 lb.

West Wyalong.—Virgin, red clay loam. August fallow; springtoothed January and April. Sown 17th May; seed, 50 lb.; superphosphate, 56 lb. Rainfall—Crop, 636 points.

Young.—Red loam. September fallow; harrowed October; scarified February and April; harrowed prior to seeding. Sown 11th May: seed 55 lb.; superphosphate, 56 lb.

In all cases the fallows were heavily stocked.

It is necessary to bluestone the seed for these experiments some considerable time—possibly from two to three months—before seeding, and hitherto the practice has been to bluestone with a 1½ per cent. solution, and to immerse the seed in lime water in order to avoid excessive injury to the grain. For the 1922 experiments, however, as bunt could not be detected in the seed, the liming was omitted and a 1 per cent. bluestone solution was used. The results were quite satisfactory—germination was excellent, and the omission of liming caused no apparent injury to the seed.

Season.

Drought conditions prevailed over the west and south-west portions of the Riverina during the season, and crop failures were common; but further east, although the rainfall was below normal, the distribution was very favourable, and fallow crops made quite robust growth, some extremely heavy hay yields being returned, notably about Wagga and towards the Murray. Early seeding was unsafe in many districts, owing to the surface soil containing just sufficient moisture to cause malting. Towards the end of April there was a pronounced break in the weather, and heavy rains were recorded through eastern Riverina and lighter falls further out. The May weather was fine and mild, and seeding proceeded with great rapidity, being completed at a much earlier date than usual, thus expediting the fallowing for the crop of 1923. The winter and spring rainfall was deficient except in favoured districts, such as Henty and Culcairn, where September precipitations of upwards of 2¾ inches were recorded. Harvest was comparatively early, and was carried out in good weather.

In the season under review, experiments were established at Hillston, where it is unfortunate that the initial effort should have encountered weather conditions so unfavourable. Owing to delays in transit, it was impossible to make a seasonable sowing at Hillston, and the plot was not planted until

5th June; it only received an effective rainfall of 242 points. In spite of this, however, the yield of the various wheats ranged from 4¾ to 9½ bushels per acre—Waratah returning the latter figure.

Notes on Varieties.

A feature of the past season has been the success of Waratah. This Wagga-bred, early-maturing wheat yielded most consistently under a range of conditions that make the results remarkable. Owing to its adaptability, prolificacy, and hardness, there can be no questioning the fact that it is destined to become one of the most popular varieties in the south.

Canberra again out-yielded all other wheats of similar period of maturity, and it is permissible to reiterate the statement that it is undoubtedly the best variety for late sowing for grain.

These early-maturing wheats are especially attractive to farmers in districts such as Bongalong, where fallowing is out of the question, for, by their rapidity of growth, they permit of relatively late seeding. and offer an opportunity for additional cultivation after the autumn rains have germinated the weed seed. The same attribute renders them extremely valuable also in the control of flag smut, which is becoming so prevalent throughout the southern wheat belt.

The comparative yields of Federation were rather disappointing. This variety is, of course, extremely disease liable, and in a season when flag smut is rampant, suffers considerable damage. The Federation plots in the wheat experiments were free from the disease, so that this objection, levelled at the general crop, did not apply. The statement that Federation is losing its capacity to yield is preposterous—the systematic selection of seed practised at the experiment farms definitely prevents deterioration.

The success of Penny is quite pronounced. This variety has long been under trial, with varying, but, on the whole, unsatisfactory results. The good average performance of Penny in 1922 was probably due to the fact that its germination was more perfect than in other seasons. It seems possible that Penny is somewhat susceptible to pickling injury, and in this direction, seed harvested under the dry harvest weather of 1921, would probably be more than usually resistant to the action of the bluestone.

Gresley repeated its success of past seasons and is now firmly established in the south. It is anticipated that there will be a marked increase in the area sown to this variety in 1923.

Turvey was included in only one experiment and was here outyielded by several of the standard varieties. The popularity of this wheat in the south is at present quite remarkable, but an early waning of its popularity is anticipated. It is a showy wheat, but it has not the yielding capacity of other varieties and is better adapted for hay than for grain.

College Purple, another wheat of the moment, failed to yield as well as other better-known varieties, and the same applies to Minister when tried out at Berrigan and Lockhart.

VARIETY Trials.

Variety.	Barellan (G. Gow).	Barellan (H. T. Manning).	Barellan (W. J. Mart'n).	Berrigan.	Bongalong.	Culcairn.	Cunningar.	Henty.	Hillston.	[illegible]
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Aussie	...	...	...	14 31	...	...	...	...	...	...
Bomen	25 6	...	13 15	...	...	...	29 34	...	...	22 59
Booran	...	...	...	10 9	...	...	...	...	...	...
Bunyip	...	...	...	...	...	...	...	...	...	...
Canberra	22 7	6 0	8 53	13 36	...	33 50	26 8	27 55	6 48	25 20
College Purple	...	...	...	...	...	25 54	27 40	24 51	...	22 53
Comeback	...	...	...	...	...	...	...	...	4 41	...
Currawa	...	14 21	...	...	17 13	...	...	...	...	...
Daphne	...	...	...	...	...	...	...	...	...	...
Queen Fan	...	...	...	...	...	...	...	...	...	...
Federation	23 0	9 36	11 50	12 9	31 52	31 55	30 13	27 16	7 38	21 51
Firbank	...	...	...	...	24 49	...	26 29	...	...	...
Florence	...	...	...	9 56	...	...	...	...	5 47	...
Gresley	20 59	...	...	16 0	32 12	35 13	26 8	27 46	...	20 1
Hamel	...	...	...	...	...	...	27 56	...	...	...
Hard Federation	...	5 5	...	12 53	27 10	...	26 43	...	...	21 7
Improved Steinwedel ...	19 43	2 47	...	...	...	...	...	...	7 4	...
Kitchener	..	...	...	9 23	...	...	...	...	...	...
Major	...	10 53	...	12 20	22 12	...	...	23 58	...	20 6
Marshall's No. 3	...	...	...	...	...	...	...	...	...	15 49
Minister	...	...	...	11 39	...	...	...	...	...	...
Moira	...	...	...	...	...	...	...	...	...	...
Nabawa	...	...	...	16 55	...	...	...	...	...	.
Onas	...	...	...	...	...	...	...	...	...	...
Penny...	25 56	15 17	13 39	13 53	29 51	26 59	27 59	...	...	21 51
Pusa No. 4	...	...	...	14 21	...	...	...	...	...	...
Smut Proof	...	...	...	...	...	...	...	...	...	...
Turvey	...	...	...	...	...	...	...	...	...	...
Waratah	...	4 59	...	...	34 6	29 0	30 36	26 13	9 36	24 27
Warden	...	...	...	...	26 0	...	...	...	...	19 3
Warren	...	...	...	...	...	...	...	...	6 4	...
Wilfred	...	...	...	...	...	...	...	...	...	...
Yandilla King	25 31	11 58	13 23	...	21 51	...	30 18	21 20	...	19 37

Variety.	Lockhart.	Mathoura.	Mirrool.	Moombooldool.	North Berry Jerry.	Rocky Ponds.	Ungarie.	Urana.	Wallendbeen.	West Wyalong.	Young.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Aussie	...	...	...	...	...	...	...	...	...	...	...
Bomen	...	...	15 26	...	30 21	31 26	...	5 52	16 52	...	...
Booran	...	...	...	...	...	...	...	...	...	...	...
Bunyip	...	..	..	13 51	...	...	...	...	...	...	...
Canberra	22 0	...	...	17 45	27 25	34 6	11 26	10 48	15 30	18 48	23 13
College Purple ...	18 42	...	...	...	26 29	28 44	...	...	...	...	24 59
Comeback	...	...	...	12 40	...	...	7 9	...	...	...	...
Currawa	..	...	...	...	24 30	...	...	6 52	19 0	...	...
Daphne	..	...	...	...	..	...	...	...	...	...	20 11
Queen Fan	...	...	...	...	..	...	...	...	...	..	23 32
Federation	20 11	14 5	13 17	15 35	29 5	32 54	13 9	8 26	18 45	18 48	26 57
Firbank	...	..	...	...	.	24 24	...	...	10 1	...	...
Florence	...	5 11	...	13 1	.	...	...	7 53	...	11 24	...
Gresley	20 16	..	...	16 2	26 0	27 40	11 9	11 25	15 5	15 25	23 35
Hamel	...	...	...	...	...	27 24	...	...	...	15 13	22 4
Hard Federation ...	...	...	12 52	14 51	25 3	29 32	...	...	...	...	24 4
Improved Steinwedel	..	7 20	...	13 36	...	...	...	7 19	...	...	...
Kitchener	.	...	...	...	...	...	..	...	...	...	...
Major...	16 4	12 8	...	17 3	29 29	...	7 51	...	...	...	27 7
Marshall's No. 3 ...	...	...	...	...	32 25	...	..	...	18 53	...	...
Minister	17 53	...	..	...	...	...	...	...	...	...	...
Moira	17 46	..	...	...	...	...	...	...	...	...	...
Nabawa	...	...	...	...	...	...	...	...	...	...	...
Onas	..	...	...	...	...	...	12 35	...	...	...	...
Penny	19 6	12 57	14 36	...	32 27	28 58	12 25	7 10	...	...	28 52
Pusa No. 4	...	...	...	...	...	...	...	...	...	...	...
Smut Proof	...	...	...	...	...	...	11 25	...	...	...	...
Turvey	17 48	...	...	...	...	...	...	...	...	...	...
Waratah	21 7	...	16 20	...	31 5	29 52	10 20	...	18 9	16 50	25 46
Warden	...	...	...	...	25 40	...	...	...	14 3	...	...
Warren	...	...	...	14 6	...	...	...	...	...	17 38	...
Wilfred	...	...	...	...	...	...	...	...	...	...	20 4
Yandilla King ...	...	11 45	14 0	16 46	...	29 40	...	2 50	17 31	...	[illegible] 12

The season was unfavourable to late maturing wheats, hence the relatively low yields of Yandilla King, Warden, Major, and other wheats of similar growing periods, which only had a reasonable opportunity to yield in late districts such as Young.

Manurial Trials.

The object of the manurial trials was further to demonstrate the futility of attempting to grow wheat in the Riverina and South-western Slopes without superphosphate, and also to collect further data relative to the most remunerative rate of application of this manure. As regards the first of these, the results of 1922 only bear out the results of former seasons, but in a greater degree than usual; after fourteen seasons the issue has been so thoroughly decided and the use of superphosphate has become so integrally a part of wheat culture in the southern district, that it seems quite unnecessary further to prove the point by maintaining unmanured plots in future experiments.

Upon the question of the actual rate of application of superphosphate, however, much valuable work remains to be done. As the standard amount for the south, 56 lb. per acre has been accepted, and in the light of previous seasons' experience it can be accepted that any reduction of this amount results in depression of yield, while any slight increase of rate of application has not hitherto brought about the increase of yield that might have been anticipated. The 1922 results bear out the foregoing, for at Barellan (on boree country and on red, light loam), at Culcairn, Henty, Hillston, Hughstonia, Lockhart, Mathoura, Mirrool, Urana, Ungarie, and Young, actual depression of yield or failure to show a profitable margin followed an increase on the standard rate, while at Barellan (red clay loam), Berrigan, Cunningar, Moombooldool, North Berry Jerry, Rocky Ponds, Wallerabeen, and West Wyalong, the results are strongly in favour of relatively heavier manuring. At Moombooldool, on a light mallee soil, a 50 per cent. increase was given by 112 lb. superphosphate as against 56 lb., and at Wallendbeen, on a sandy loam of low fertility that had been under cultivation for upwards of forty years, an increase of 40 per cent. was achieved by the same rate. At Rocky Ponds the margin was comparatively narrow, while at Cunningar 84 lb. superphosphate gave a 20 per cent. heavier crop than 56 lb. The failure of the heavier application at Culcairn and Henty is surprising, the success of 84 lb. superphosphate having hitherto been quite marked.

From the mass of figures presented in the table of results, it can be taken as strongly advisable to retain the present standard of 56 lb. per acre. The success of the 84 and 112 lb. per acre dressings, however, indicates that the quantity which can be applied depends upon local conditions—particularly of the soil—and farmers are therefore advised to make a small trial with the larger quantities on their own farms with a view to ascertaining whether or not it is profitable to increase the quantity of fertiliser used.

MANURIAL Trials.

Amount of Superphosphate per acre.	Barellan (G. Gow).	Barellan (H. T. Manning).	Barellan (W. J. Martin).	Berrigan.	Culcairn.	Gunningar.	Henty.	Hillston.	Hughstonia.	Lockhart.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Nil	13 47	6 29	8 38	4 8	20 40	25 35	...	...	6 21	14 37
28–30 lb. ...	19 41	...	...	8 16	24 55	...	...	7 38	...	18 9
42–45 lb. ...	...	...	11 50	...	27 40	...	...	8 25	19 37	...
52–56 lb. ...	23 0	9 36	...	12 9	31 55	30 13	27 16	7 0	...	20 11
60–65 lb. ...	21 44	...	12 0	...	...	...	...	...	...	...
70–75 lb. ...	...	12 0	...	...	...	...	29 30	...	...	...
84 lb.	...	...	12 8	14 35	32 46	36 34	...	...	17 28	19 4
97 lb.	...	...	...	...	...	...	29 55	...	...	...
112 lb.	...	...	...	...	...	...	...	...	17 16	...

Amount of Superphosphate per acre.	Mathoura.	Mirrool.	Moombooldool.	North Berry Jerry.	Rocky Ponds.	Ungarie.	Urana.	Wallendbeen.	West Wyalong.	Young.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Nil	9 17	7 12	8 26	...	26 50	8 27	4 42	9 18	11 25	22 19
28–30 lb. ...	9 30	...	...	...	...	10 29	6 45	...	15 38	...
42–45 lb. ...	...	13 17	...	...	...	...	...	...	...	...
52–56 lb. ...	14 5	...	15 35	...	32 54	13 9	8 26	17 21	18 48	29 12
60–65 lb. ...	...	12 22	...	29 5	...	...	...	...	...	...
70–75 lb. ...	...	...	19 5	...	...	...	...	...	20 8	...
84 lb	14 5	13 21	...	30 9	...	...	8 57	19 27	...	30 20
97 lb.	...	...	...	...	...	...	...	...	...	...
112 lb.	...	...	23 0	32 23	34 36	13 40	...	24 52	...	25 54

Rate of Seeding Trials.

Trials with various rates of seeding were carried out at Barellan (G. Gow); and at West Wyalong, the results being as under :—

Amount of Seed.	Barellan, Sown 18th April.	West Wyalong, Sown 17th May
	bus. lb.	bus. lb.
36 lb. per acre	21 54	....
40 ,, ,, ...	....	17 57
48 ,, ,, ...	23 0	....
50 ,, ,, ...	....	18 48
60 ,, ,, ...	21 27	15 38

In each instance the medium amount of seed, namely, 48–50 lb. per acre, returned the highest yield. It should be noted that the seed was graded and sown on fallow, both of which are powerful factors. At the same time it is usually considered necessary to make heavier seedings on the boree country (Barellan) to secure perfection of stand, but in this case the abnormally dry season was in favour of lighter seeding.

Oat and Barley Trials.

Oat variety trials were carried out in conjunction with the wheat experiments at Barellan, Culcairn, Henty, and Wallendbeen, being seeded under circumstances identical with the wheats.

The outstanding feature of the oat plots was the phenomenal success of the two quite new and early maturing varieties, Quondong and Mulga, both of which gave a 50-per cent. increase over the standard variety (Algerian) for the southern district at Culcairn. Under Australian conditions the variety that sets its grain quickest can usually, other things being equal, be taken as the most valuable. The advent of these prolific and early maturing oats may be regarded with great favour, as they effectually remove the main objection to oats being grown in rotation with wheat—that of its clashing with the wheat harvest owing to the late maturity of the varieties of oats hitherto in cultivation.

At Wallendbeen all the more advanced varieties were very severely storm damaged, heavy wind just prior to harvest reducing the yields of grain to a marked degree.

OAT Variety Trials.

Variety.	Barellan. (W. J. Martin).	Culcairn. (A. H. Jennings).	Henty. (Kulenstein Bros.)	Wallendbeen. (J. T. Williams).
	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Algerian	17 13	45 0	41 1	36 35
Guyra	....	....	....	32 28
Lachlan...	14 9	38 3	36 10	....
Mulga	16 10	67 33	....	24 16
Quondong	13 33	66 35	....	24 32
Ruakura	....	....	....	21 24
Sunrise	....	....	....	21 26
Yarran	....	....	....	34 30

Owing to the waning popularity of barley in the southern district, trials were carried out at only one centre, Wallendbeen, where the barleys were sown under conditions identical with those of the wheat experiments.

The yields were as follow :—

Trabut ... ... 30 bus. 16 lb. per acre.
Kinver ... ... 28 bus. 41 lb. „

Currawa with 19 bushels returned the highest yield of the wheats under trial at Wallendbeen, indicating the relatively greater prolificacy of the barley.

Fallowing Experiments.

The Barellan fallowing experiments, carried out by Mr. W. J. Martin of "Rotherwood," Barellan, were suggested by Mr. L. Judd when acting as assistant to the writer in 1921. The experiment is intended to determine

what modifications of the present fallowing system are necessary to ensure maximum yields, and further to test the efficacy of cultivation against non-cultivation of fallows.

The experiment was located about 10 miles north of Barellan towards Yalgogrin, and was on virgin, red light loam—box and pine country merging into mallee. The experiment was 25 acres in extent and was divided into five blocks, each of 5 acres.

The cultural details are as follow:—One plot was ploughed each month from July to October inclusive, and they were worked in October, January, and April by harrowing, this owing to the nature of soil and season being all that was necessary to provide a satisfactory seed-bed. An additional July-ploughed plot was held unworked save for a cultivation immediately prior to seeding. The plots were heavily stocked throughout the fallow period.

The rainfall on the various fallow plots was as under:—

Ploughed in July	1,026	points.
,, August	816	,,
,, September	631	,,
,, October	537	,,

The rainfall of the growing period was 687 points.

The experiment was seeded on 22nd April with Federation at the rate of 50 lb. per acre with 42 lb. of superphosphate. The results were as follows:—

	bus.	lb.	
July fallow (worked)	11	16	per acre.
July fallow (unworked)	11	5	,,
August fallow (worked)	11	1	,,
September ,, ,, ...	10	46	,,
October ,, ,, ...	6	40	,,

As stated earlier, the seasonal conditions were unfavourable owing to the deficiency of the spring rains, but the figures indicate the benefits of relatively early as against late fallow and also the possibilities of unworked fallow, the results being taken as a victory for the latter, as it will be observed that two cultivations of the July fallow only increased the yield by 11 lb., or approximately 1¼ per cent. over the unworked fallow. Further, this occurred in a season when cultivation might be regarded as even more essential than usual and upon virgin soil—two factors that would exert a strong pull in favour of working.

The advantage of early over late fallow may be attributed to additional moisture conservation and weed control. In the southern district the object of fallowing is to catch and to carry over the greatest bulk of the winter rain for the use of the subsequent crop, hence the earlier the land is broken the greater the amount of percolation and consequent storage of moisture—and the greater the likelihood of germination of the black oat.

As far as the results of one season go, the data collected in 1922 at Barellan can be accepted as a striking testimony to the efficacy of a system of early, unworked, heavily stocked fallow, and it has been the experience of the writer that the Riverina loams can be readily overworked, that it is preferable to depend mainly upon sheep for the control of fallow weeds, and that refraining from more cultivation than is absolutely essential is necessary to avoid a possible condition of over-fineness, even at the expense of a certain amount of soil moisture.

The Barellan fallow experiments will, it is hoped, be continued over at least five seasons.

Economy in Farm Labour.

To the man without a family of working age, the matter of getting all the various jobs about the farm done efficiently and economically is one which at times causes much anxiety. The Government is desirous of helping the man on the land in this direction, and for some time past has been introducing respectable youths from Great Britain who undertake to engage in rural work Some of these are sent to the Government Training Farm at Scheyville, which is worked in conjunction with the Labour Exchanges and Immigration Office, while others go to the Government Experiment Farms at Wollongbar, Grafton, Cowra, and Glen Innes, at each of which the lads are taught to do the various classes of work needed upon a farm, thereby ensuring that they will be useful from the outset to any farmer who is disposed to take advantage of the opportunity of securing a lad from one of these sources.

To meet the wishes of those who prefer to train the lads in their own methods, a number are also being introduced who will be available to go direct to employment upon arrival. Applications for these should be made to the Director of Labour Exchanges and Immigration, at 78 Elizabeth-street, Sydney.

The Business of Farming.

The business of farming differs greatly from the business of the manufacturer, because the manufacturer knows definitely when he commences to manufacture an article that it will be delivered and sold as such. The farmer, on the other hand, does not, as a rule, end the year's work by selling off the farm the exact article or the exact quantities he set out to produce. He may, for instance, as his judgment directs, either sell his oats as hay, or feed it to stock; or may allow it to ripen and sell as grain as the season and prices dictate. The actual price offered for foodstuffs off the farm, is not, therefore, always the governing factor in influencing the farmer to sell his produce. In this sense the farmer, to be successful, needs to be a good man of business. —A.I.F. Education Service, Land Book No. 3.

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Mediterranean Thistle (*Carthamus dentatus* Vahl.)

Botanical Name—Carthamus.—From the Arabic, *qurtom*, to paint; referring to the flowers of some species yielding a fine colour; *dentatus*, in reference to the toothed leaves.

Common Name.—Mediterranean thistle.

Popular Description.—A hardy, spiny annual, with branching, leafy stem 6 inches to 3 feet high or more. Leaves short, pale green, strongly veined, edged with short spines, and ending in a long spine. Flowers pink or purple, about 1 inch long, surrounded by leaf-like, spiny, bracts exceeding the flowers. In general appearance it is similar to the Saffron or False Star thistle, from which it is distinguished by its broader leaves, less woolly stem, and pink or purple flowers. The flowers of the Saffron or False Star thistle are yellow.

Botanical Description.—Annual or biennial; stem erect, corymbose, villose or glandular pubescent; leaves pubescent-viscid; the lower divided into linear-lanceolate, toothed divisions; the upper or stem-leaves coriaceous, venulose, semi-amplexicaul, lanceolate, spinous-dentate, sub-recurved, 1 to 3 inches long. Inflorescence terminal; heads solitary, about 1 inch long; outer involucral bracts leaf-like, pubescent-viscid, terminating in long spines exceeding the head; inner ones lanceolate, a few pectinate-spinose; flowers pink or purple; pappus chaffy, longer than in *C. lanatus*.

Where Found.—It is a native of Greece, Macedonia, Turkey, and Asia Minor. Introduced into Scotland, probably by wool from the Mediterranean.

Its Appearance in New South Wales.—In February, 1921, a specimen was received from Murrumburrah, but owing to its imperfect state it was passed over as the Saffron or False Star thistle. Early in January of this year, Mr. T. G. Wernham, Shire Clerk, Murrungal Shire, Boorowa, forwarded a specimen of the species for determination, with a view of having it declared noxious. It was also received from Mr. F. Lidswell, Boorowa, early in March. From the localities quoted, it would appear that it has been in the State for some considerable time, as it appears to be well established. No doubt it has hitherto been mistaken for the Saffron or False Star thistle.

A Bad Weed.—It has every appearance of being a very bad weed. In fact, it has no redeeming features to recommend it, and it possesses all the bad characters of the Saffron or False Star thistle. It is an adaptable plant and has numerous sharp spines as a protection against grazing animals. Even if it were unarmed, its harsh, dry leaves and stems would be valueless for fodder. Mr. T. G. Wernham refers to it as follows: "In this shire it is becoming a greater nuisance than the Saffron or False Star thistle, to which it seems to be closely allied. It grows in poor soil as well as in the richest,

Mediterranean Thistle (*Carthamus dentatus* Vahl.)

A. Plant. 1. Seed of *Carthamus dentatus*. 2. Seed of *Carthamus lanatus* (for comparison)

and attains a height of from 6 inches to 3 feet, according to the soil and season, with an average height of about 2 feet." Mr. Wernham was advised to have it declared noxious within the Murrungal Shire.

Means of Control.—Constant cutting during the growing season with hoe or machine to prevent the development of flowers and seed. If taken in hand at the proper time, about two cuttings will have the desired effect. Where the growth is dense on roadsides, headlands, and pastures, an application of hot brine or salt on the freshly-cut parts will help to kill it. In pastures, weeds of this kind destroy the native herbage and grasses, and every effort should be made to replace them with the best kinds of winter, spring, and summer grasses. It must be borne in mind that a well-grassed paddock is a protection against weeds, and a source of revenue to the owner.

In cultivation, rotation crops are recommended, and a start should be made to deal with it as soon as the harvest is over. Infested stubble should be burnt off or ploughed under, and the ground prepared for spring or summer crops.

Pasture Improvement Work at Taree.

An inspection was made during May of a number of grass and clover experiment plots in the Taree district, the most promising grasses being Toowoomba Canary (*Phalaris bulbosa*), cocksfoot and Perennial rye.

A large number of farmers are sowing these grasses along with Perennial Red clover, and are obtaining excellent results, as they provide a large bulk of succulent autumn and winter feed for dairy cows.

At Dumaresque Island Messrs. W. J. Adams and B. Richardson have excellent paddocks of cocksfoot, Perennial rye and Perennial Red clover, which were planted during the late autumn of last year, the mixture of grasses and clover coming through the dry spell satisfactorily, and responding rapidly to the recent rains. Mr. Richardson is also growing *Phalaris bulbosa*, a most valuable winter grass.

Mr. John Mooney, also of Dumaresque Island, has one of the best areas of rye grass and clover to be found anywhere in the State; it is excellent in density and height of growth, and free from disease.—J. N. Whittet, Agrostologist.

Some Free Leaflets.

"Bulk Handling of Wheat" is the title of a small booklet recently added to the Department's free list. It is well illustrated, and is designed to explain the system, and how it is of benefit to the farmer. Leaflets, called "Spray Leaflets," are available and are of special interest to orchardists at this time of the year. They deal with all the common formulas and their application. Another new leaflet of general interest, entitled "What the Department Does for Farmers," gives an outline of the activities of the different branches of the Department and the assistance rendered to farmers in the solution of their problems.

Farmers' Experiment Plots.

Trials with Mangolds, 1922–23.

Central Coast.

J M. PITT, Senior Agricultural Instructor.

Variety and manurial trials with mangolds were conducted by Mr. B. Allen, Oxley Island, Lower Manning, during the year.

Probably no other agricultural crop yields as heavily as the mangold under equal conditions. Over 90 tons to the acre have been harvested in New Zealand. Although the most watery of all the root crops, mangolds are, nevertheless, most valuable and highly nutritious. Apart from their qualifications as milk stimulators when used in combination with other ingredients, the mangold is undoubtedly a crop of great value where pig-raising is a part of the farm proceedings. They play a prominent part in the dairying industry of New Zealand and other countries where, on account of the colder climate, other green, succulent fodders and pastures such as we are accustomed to here are only available for a limited number of months.

The average yield in New South Wales, under suitable conditions, is, roughly, 25 tons to the acre, but this average can be greatly exceeded if a little judgment be exercised, first, in the selection of the plot (usually only a small area, governed by the number of pigs kept and to be raised); second, in the thorough preparation of the plot. Mangolds require a fairly rich, deep, loamy soil, and there are usually many acres with these qualifications on the great majority of farms where dairying and pig-raising are practised.

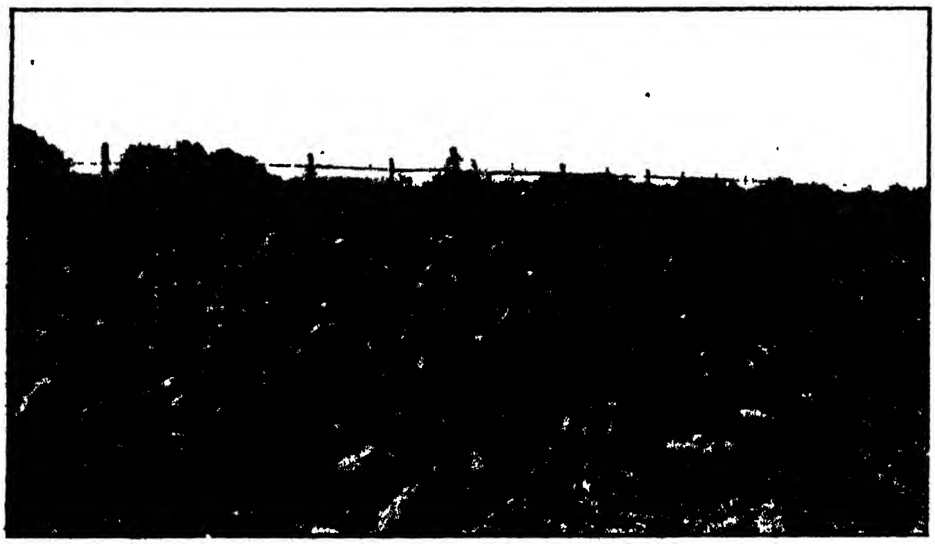
According to statistics, only 1 acre was sown in 1920–21 season to mangolds in the counties comprising the Central Coast. It would be difficult even to surmise why the crop is not grown more extensively. Whatever the cause may be, farmers, or the great majority, display surprising ignorance when they view the specimens displayed at district shows. The question, "What are those ?" is very commonly asked.

A Record Established.

The yields in the plot under review exceeded those of the 1921 trials at Mount George by about 2 tons, thus establishing a record. The plots at Mount George were sown on a deeper soil, and had the advantage also of a good average rainfall, but the stand was thin. At Oxley Island the soil was lighter, and probably not as rich, and the season from the end of September

until the end of February was, in the opinion of the older inhabitants. one of the driest and hottest, if not the worst, experienced on the river, During the period when moisture was required to fill out the roots, only 6 inches of rain fell at Taree, and considerably less fell at Oxley Island. The majority of the registrations were small and useless. The high yields were due to the well-prepared seed-bed, the excellent, even stand (thinned to 15 to 18 inches apart) following a good germination, and to the excellent drought-resistant qualities of the crop.

Many roots ranged between 20 and 30 lb. each, chiefly of the Mammoth and Giant Half-sugar varieties. The Yellow Globes, although smaller, were a nice even lot and were solid, being entirely free from the "hollow centre" sometimes found in the other varieties.



Portion of the Crop of Mangolds at Oxley Island.

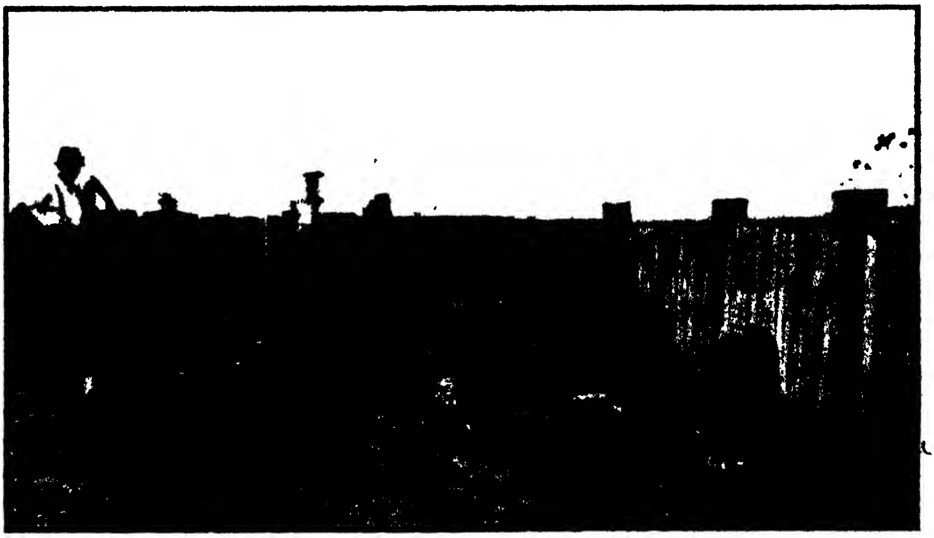
Many of the largest mangolds had been thinned out for feeding, harvesting having commenced in November, while the photograph was not taken until February.

Many of the ordinary farm crops growing in the neighbourhood—maize, saccaline, pumpkins, &c.—were a partial failure, due to the dry conditions, and the lucerne fields remained stunted. The preparation of land during the later spring and summer months for successive sowings was an impossibility owing to a lack of moisture. The mangolds, however, established in a more favourable season, made satisfactory progress throughout, and with the addition of skim milk and very little grain, fed and fattened several lots of baconers, and at the same time kept the breeding stock (some fifteen or sixteen head) and a number of weaners and stores going from early November until mid-March, when the bed gave out.

The Plot.

The previous crop had been potatoes, for which the land was well worked. After the harvesting of this crop the land was ploughed, and the surface soil kept in good tilth by light disc ploughings. The seed-bed was fine and in good order.

The seed was hand-dropped in shallow drills opened 3 feet apart, and covered with the hand rake. There was an excellent germination. When well established the plants were thinned out to about 15 or 18 inches in the drills with the hoe. Heavy falls of rain until late September kept the plants growing strongly. When some of the plants were still too close they were thinned, and the roots fed to the young pigs during August; but this practice is not to be recommended, owing to the scouring that results. This probably can be overcome by boiling the roots before feeding. Two or three single cultivations were given to check weed growth.



Breeding Pigs eagerly devoured the Mangolds at Oxley Island.

Mammoth Long Red is still the heaviest yielding variety, although Giant Half-sugar White was very little inferior. The shape of these varieties is somewhat similar. The Yellow Globes were a very solid, even-sized lot.

The application of fertiliser was very beneficial, 2 cwt. superphosphate showing an increase of over 6 tons to the acre, whilst the P. 9 mixture at 2 cwt. per acre was hardly as good, although nearly 2 tons in excess of the no-manure plot.

Rainfall at Taree.

Falls were heavier at Oxley during winter, but considerably lighter during spring, summer, and autumn, owing to storms missing that direction. The

following are the registrations for the growing period:—June, 189 points; July, 1,313; August, 694; September, 1,070; October, 151; November, 12; December, 181; January, 1923, 311; February, 37 points.

RESULTS of Trials.

Variety Trial.			* Manurial Trial.		
Variety.	Yield per acre.		Manure.	Yield per acre.	
	tons	cwt		tons	cwt
Mammoth Long Red...........	45	9	No manure (average of two plots)...	43	12
Giant Half-sugar White.......	38	17	Superphosphate, 2 cwt. per acre.....	50	1
Yellow Globe	34	12	†P 9 mixture, 2 cwt. per acre........	47	3

* The variety used in the manurial trial was Mammoth Long Red.
† P9 mixture consists of equal parts of bone-dust, superphosphate, and potash.

WHAT IS TILTH?

IN order to understand the true meaning of tilth it is necessary to consider the ultimate mechanical constitution of the soil. The sand, silt, and clay particles, if they were all separate, would form with many soils, especially the heavier ones, a solid mass with practically no free air space. Soils which have been incorrectly manured and cultivated get into this state, and it is often a matter of great time and expense before the soil particles can be aggregated sufficiently to form the "crumb" by which good tilth can be recognised.—C. R. HARLER, B.Sc., A.I.C., in the *Quarterly Journal* of the Scientific Department of the Indian Tea Association.

THE ONLY "CHANGE OF SEED" WORTH WHILE.

THERE is a tradition among farmers that change of seed is necessary. The truth is, however, that unless the change be simply a substitution of a better variety of more vigorous seed, or of seed that has been subjected to more careful and continuous selection, there can be no advantage from the change. And if the new seed is to be grown under different climatic conditions it may mean a decided disadvantage, at any rate until it becomes acclimatised.—A.I.F. Education Service, Land Book No. 4

FREE BOOKLETS ON FARMING SUBJECTS.

THE Department has in hand the residue of literature issued in connection with the Education Service of the A.I.F., and soldier settlers and others are invited to make application to the Under Secretary and Director, Department of Agriculture, Sydney.

The titles of the publications are:—The Business of Farming; Land Selection and Improvements; Wheat and General Farming; Irrigation; Beef, Mutton and Wool; Pig-raising; Bee-keeping; Viticulture.

The Testing of Pure-bred Cows in New South Wales.*

L. T. MacINNES, Dairy Expert.

At your last annual meeting it was pleasing to record that the testing year 1921–22 was, from a production view-point, the best experienced by dairy farmers in this State. At this year's meeting we have to look back on one of the worst years experienced, and the prospects for the coming winter are dark for dairy stock owners. These extreme seasonal changes emphasise the need for some financial scheme being at once adopted, in order that fodder may be conserved on all dairy farms to meet such periods of scarcity.

Decline in Number of Cows being Tested.

For year 1921–22, a total of 640 pure-bred herd book cows were recorded for production (273-day period). For the year ended 28th February, 1923, this number was increased to 717 (an increase of 77, or 12 per cent.). The increase reported twelve months ago was 20 per cent. For the first six months of the testing year now under review there was a far larger number undergoing test than during the latter portion of the year. Twelve months ago it was confidently expected that at this meeting I would be in a position to announce that the number of herds and cows tested had increased 100 per cent.

Increased Fees.

The reason why this expected increase did not materialise was the great increase in the charge made for testing—from 5s. per cow to 35s. This increase was caused by financial stringency at the Treasury. The New South Wales Government, like all others in every part of the world, was and is, feeling the effects of the late war.

A scheme whereby fees could be reduced to about 10s. or 15s. per cow to the breeder, and by which the Department only incurred 50 per cent. of the cost, was submitted. As the success of the scheme meant some form of compulsion on the part of the breeders' societies towards their members in regard to having all registered stock tested, and as such compulsion was not acceptable to the societies, this scheme was not adopted. A request by the Department to submit counter proposals, whereby the objects aimed at can be achieved, is, I understand, to receive attention during this or next week. Anything brought forward, if in reason, will receive the sympathetic support of the Department. The Minister for Agriculture recognises the importance

* Extracted from the official report presented to the annual meeting of the United Pure Bred Dairy Cattle Breeders' Association of New South Wales, covering the year ended 28th February, 1923.

of fostering the herd-testing movement, both in regard to pure-bred stud stock and ordinary dairy herds. Everything possible will be done to help you to help yourselves in this direction.

Number of Cows under Test at 1st March.

The number of cows under test at 1st March, 1920, was 473; 1921, 524; 1922, 738; and 1923, 366 (a decrease of 372 as compared with the previous year).

There were forty-six private herds being tested at 1st March, 1923— a total of eighty-six was on record during the twelve months, a number corresponding with the 1921–22 results.

One cause of the great falling-off in both number of herds and number of cows now in the testing scheme has been alluded to; another important factor bearing on this decline was the drought. The severity of the season is demonstrated by the small production of butter, &c. For 1921–22 we exported 16,000 tons of butter overseas; during the season just concluded, this figure has been reduced by, I think, more than half.

The total number of records of cows tested to date is as follows:

Number to 1918 ...	1,547	Number during 1921–22	640
" during 1918–19	170	" " 1922–23	717
" " 1919–20	429		———
" " 1920–21	532		4,035

The number of privately-owned cows tested in 1922–23 increased by 41, from 540 to 581.

Features of the Year's Testing.

I have again to announce that leading cows of each breed have put up fine records over 273 days as follows:—

	Milk. lb.	Butter-fat. lb.
Milking Shorthorn	22,597½	988·17
Illawarra	13,501½	642·61
Jersey	11,980½	690·12
Guernsey	10,606½	555·63
Ayrshire	16,344	648·08
Friesian	18,909¾	624·1

Fresh records have been established in the following breeds.—

Breed and Animal.	273 days.		365 days.	
	Milk.	Butter-fat.	Milk.	Butter-fat.
	lb.	lb.	lb.	lb.
Milking Shorthorn (Melba XV)	22,597·5	988·17	29,432	1,316·81
Ayrshire (Lucy of Denbigh)	16,344	648·08	....	....
Jersey (Olivette)	....	....	15,535	900·21
Guernsey (Hope of Wollongbar)	12,856·5	746·8	15,907	949·26
Friesian (Woodcrest Johanna Tehee) ...	....	....	25,628½	867·37

Melba XV, an all-Australian cow—Australian bred, Australian breeder, and Australian fed by mostly home farm-grown fodder—has put up a performance that was, for a time, a world's record. This record has since been passed by a Canadian Friesian cow. Canada is to be congratulated, also her star breeder; but Mr. Cole and many others in New South Wales are going to try very hard to put up a better record still. Mr. Cole as a breeder has made for himself and the stud he manages a world-wide reputation. Melba XV and the Milking Shorthorns are everywhere talked about.

The 1,000-lb. Cows.

It has been customary to record and specially mention the thousand-pound butter cows; now we must adjust our expression to 1,000-lb. butter-fat cows. But I would like to mention here that again our testing scheme has brought out the 1,000 lb. performers Melba XV (Milking Shorthorn), Hope of Wollongbar (Guernsey), Olivette (Jersey), and Woodcrest Johanna Tehee (Friesian). This makes nine (9) such records since 1917.

Herd Testing Associations.

By reason of the bad season experienced in all dairy districts, herd testing associations have lessened in number. There were sixteen at work at 28th February, 1923, testing about 15,000 cows as against 35,000 last year.

The movement is being reorganised by the Department in conjunction with the Primary Producers Union, and it is expected, with the return of a better season, that the number of cows tested each year will be greatly increased, and that soon it will be necessary to record by hundreds of thousands instead of by the score of thousands.

Remarkable Disparities Revealed by Herd Testing.

The economic significance of records in relation to the production of dairy cows is well illustrated by figures obtained from tests carried out at Utah Agricultural Experiment Station. The *International Review of the Science and Practice of Agriculture* sets out the quantities and values in currencies not familiar to the Australian farmer, but the differences between the yields of the cows which were proved to be the best and those proved the worst are equally arresting, whether stated in kilogrammes or in pounds.

The records of twenty-six herds of dairy cows for a biennial period ending in 1913, proved that the difference between the annual production of butter (water-free) of the best and of the worst cow of a herd, ranged from 18 to 148 kilogrammes. There was no correlation between the production of the three first months and the annual production. There is a decrease in yield when the cow remains dry for more or less than two months. A dairy cow of a good breed shows a marked tendency to long lactation; she is as superior to a poor cow in annual butter production as in butter production during the first month.

Comparison between the best and the worst herd showed that the annual butter production of the best herd was 149·9 kilogrammes as against 89·4 for the worst. The cost of feed per annum was 229·01 francs as against 177·29, leaving a profit on the cow of 362·57 francs for the best herd, as compared with only 174·18 for the worst.

The Action of Bacteria.

Their Effect on Dairy Products.

H. D. BARLOW, Senior Dairy Instructor.*

In order to lead up to the subject of the relation of bacteria to dairy products it is desirable to consider the treatment of dairy products, and the agencies which have a deleterious effect on the quality of those products.

The dairy-farmer's chief concern, having produced his milk or cream, is whether his product will keep or remain in good condition until he is able to deliver it to the factory, and this immediately brings us to the question as to what conditions or causes are responsible for the products failing to keep. When we say that cream does not keep, we mean that it has developed a taint or flavour which is not normal, and on the character of this taint will depend the quality of the cream. Milk, fresh from a normal healthy cow, when it loses its animal heat should be free from any taint whatever, but it may acquire a taint from (*a*) food, (*b*) absorption, or (*c*) bacteria.

(*a*) Food taints may be due to the cows eating such things as clover, carrot weed, turnips, &c., in large quantities. When very strong, certain food taints may be extremely objectionable—the taint of carrot weed in cream it is almost impossible to remove, and cream so tainted must be graded lower than choicest—but in the main the treatment which the cream receives during manufacture will remove a lot of weed taints, although carrot weed and allied taints are very troublesome at times.

(*b*) Aborbed taints from strong-smelling subjects, as kerosene, tar, benzine, onions, pineapples, &c. To effect a remedy remove the cause.

(*c*) Bacterial taints are by far the worst, and practically govern the treatment of dairy produce.

Before we can understand the action of bacteria on milk, &c., it is necessary to know something about their life-history and habits. Bacteria are the smallest known forms of plant life, and individually are only visible through a powerful microscope, although colonies or groups, which may consist of countless millions, can be seen with the naked eye. Their life-history is very much like that of an ordinary plant, inasmuch as they require food, warmth, and moisture before they will grow, but provided they have these essentials they grow and reproduce with great rapidity. Most bacteria reproduce themselves by breaking into two parts, each part of which grows, and in its turn breaks into two, and it has been calculated that in twenty-four hours, one division each hour, one bacteria would amount to 16½ millions, and in less than five days their volume would equal that of the

* Notes of a lecture delivered before the Eltham branch of the P. P. Union.

entire ocean. This is purely hypothetical, and is impossible in reality on account of deaths due to natural causes, &c., but considered as an example, it stresses the advisability of keeping the original numbers as low as possible.

The reason why milk is so easily affected by bacteria is that, firstly, it is an ideal bacterial food, as it contains all the constituents which most bacteria require for their proper development. It also supplies the moisture necessary, and is usually at a temperature which is suitable for its propagation or growth. Although it is a well-known fact that certain types of bacteria are to an extent helpful in certain branches of dairying, nevertheless the dairyman's aim should be to deliver milk or cream as free from bacterial life as possible. It would be possible to have countless millions of dead bacteria in milk, without their bulk or presence making the milk objectionable, nevertheless a very much smaller number alive are very objectionable, as they multiply very rapidly, and their action is to produce more or less of chemical change in the milk, which change is usually associated with fermentation or decomposition, and in extreme cases with what is known as putrefaction. The length of time any of these stages will take will depend firstly, on the number and class of bacteria present; and secondly, on whether the conditions are ideally suitable or otherwise for their development. The class of bacteria which are encountered in milk infection are usually controlled by the source of infection; this is to say, very bad infection, such as rotting cow-dung, putrefying matter, rotten milk, filthy utensils, &c., would be expected to produce a bad infection. It is nevertheless well to remember that very much better conditions may, and very often do, produce the same class of bacteria, though not necessarily in as large numbers, and for this reason it is never safe to leave the slightest thing to chance when it is a question of combating bacterial life in any form.

The two main points for dairymen to consider are, firstly, how to prevent as far as possible the milk becoming contaminated; and, secondly, how to prevent any bacteria which may have affected the milk from developing. Milk, when in the udder of a healthy cow, is practically free from bacteria, therefore the bacteria enter the milk after or during the milking period, and preventing these bacteria entering the milk is our main trouble.

How do Bacteria enter Milk.

Bacteria may enter the milk in several ways. Large numbers may be in (1) the lower part of the teat, and these are usually associated with cow-dung, dirty water, &c., and are very harmful. Other sources are (2) dirt from the cow's udder and sides; (3) the milker's hands and clothes; (4) unclean buckets; (5) dirty or dusty yards and bails; (6) flies, &c.; (7) unclean straining cloths; (8) unclean separators; (9) unclean separating or cream room and surroundings; and (10) unclean cream cans.

The methods of preventing or minimising contamination from these sources must necessarily be suited to the cause. As stated before, bacteria require food, warmth, and moisture to propagate quickly, and this climate and milk are ideal for those conditions.

(1) The first source of contamination in healthy cows is in the teat; it is therefore advisable to discard the first milk from each teat, which in any case is not rich in fat.

(2) Cows' udders and flanks should be brushed, if dirty, and then wiped with a wet cloth. This has the effect of firstly removing any dirt, and the damping prevents a large amount of dust, &c., from falling into the bucket.

(3) Milkers' hands should be washed after the milking of each cow. This prevents dirt accumulating on the hands, minimises the danger of carrying disease from one cow to another, and also lessens the chance of milkers getting sore hands. Water containing a little formalin should be used for this purpose.

(4) Clean buckets are buckets that are free from all bacterial life, and have been properly cleaned and scalded since last using. The slightest trace of any dried milk or grease means that considerable bacterial life is present, usually of a harmful nature, and these bacteria will be in a position to start growing the moment they come in contact with the milk.

(5) The bacteria, which live in dung, &c., are, as mentioned before, particularly objectionable to milk, and among them are found most of the organisms which cause fermentation; therefore, the freer the yards and bails are kept of manure, the less chance of infection from this source, as the smallest breeze will lift the dust and deposit numbers of bacteria in the milk. A lot of infection from this source can be prevented by keeping all cans covered and on the windward side of the bails, always remembering also that the milk must be kept free from the contaminating smell of urine, &c. If water is available the bails and yards can be washed down after each milking; contamination from this source will then be practically nil.

(6) Strainers. Although nobody would argue against straining milk, nevertheless, if the operation is not done properly, it may itself be the cause of much trouble. An efficient strainer should remove as much foreign matter as possible from the milk, it should be large enough, and it should be easy to clean. With regard to cleaning, all strainers should be free from grooves, &c., which might collect milk, and it is more satisfactory if the gauze can be removed for washing. If cloths are used it is absolutely essential that these be washed, boiled, and dried after each milking, otherwise they are often a bad source of infection. If any large lumps of dung, scabs, &c., are noticed in the strainer, these should be washed out before the next milk is put through; as otherwise they may become dissolved and the bacteria they contain will be washed through into the milk.

(7) An unclean separator or a separator which is not washed after each using is a very bad source of infection, because the infection will consist of live virile organisms. As the modern separator is so easily cleaned, and in the majority of cases free from any corners, &c., and can all be boiled after use, it should be the last cause of trouble.

(8) The separating or cream room should be so constructed that the floor drains quickly, and both the floor and at least some distance up the walls are quite impervious to moisture. It should be free from any acute corners,

so that it can be easily flushed out each day with boiling water. Very many troubles in milk and cream, which is otherwise well looked after, can be traced to bacteria breeding in cracks in floors and walls, &c., of separating and cream rooms. Good ventilation is essential in cream rooms. No wet bags or cloths should be allowed to remain about, as they are a harbour for mould growths, &c. The room should also be guarded against any infection from pigs, fowls, ducks, dogs, &c.

(9) In many cases the cream cans are a very bad source of contamination, and care should be taken that only rustless and seamless cans are used, and that they are thoroughly washed and scalded with *boiling* water and allowed to cool and thoroughly drain before any cream is put into them. Petrol tins, which are often used for storing cream, are a very grave source of infection, chiefly on account of the cream which collects in the seams. This trouble can be minimised by having the seams filled with solder before using, but a tinned steel, seamless bucket or can, is preferable.

Importance of Cooling.

The first step is to reduce the risk of infection: the second is to prevent such organisms as have gained access from multiplying to sufficient numbers to cause trouble. The only way to do this is to cool the cream as much and as soon as possible. In a climate such as ours this is one of our biggest troubles. In the absence of water being laid on to the separating room, any of the small water-bag coolers, to cool the cream straight from the separator, are very efficacious, as every degree we bring the cream below 80 degrees Fah. will have a retarding effect on the bacterial development, and in many cases (in relation to weed taints, &c.) the aeration will improve the flavour. If a cooler is not available a lot can be done by standing the cream cans in cold water, or putting wet bags round them, but it must always be remembered that fresh water is advisable each day, and the bags should be changed each day and allowed to dry. The cream should be stirred with a tinned metal stirrer two or three times each day, and not be mixed until each lot of cream is cool. Finally, the cream should be delivered to the factory daily, if possible.

Boiled down, the production of a first-class article means:—(1) Thorough and systematic cleanliness; (2) keeping the temperature of the cream as low as possible; (3) delivering the cream to the factory as soon as possible.

With reference to the delivery of cream, many people, after taking as much care as possible on the farm, allow the product to become heated in transit to the factory, either by not having a well-shaded stand or, when they do the carting themselves, by not taking the trouble to keep the cans covered (by, say, clean wet bags). This neglect may very often be fatal.

Cleanliness

As the great majority of the defects of milk and dairy products arise through lack of cleanliness, a few remarks concerning the cleaning of the surfaces with which the milk comes into contact will not be out of place. If

the cleaning is to be effective, the dirt must not merely be completely removed, and the organisms present must not only be killed, but care must be taken that no fresh organisms are introduced.

The main object in cleaning is to get rid of the micro-organisms, and as these are usually embedded in the dirt, the first step is to secure the removal of the dirt. In doing this, the great majority of the organisms will be removed as well, while the few which remain will be prevented from multiplying owing to lack of nutrition. In order to remove the dirt, which in the case under discussion consists of the constituents of milk, it must be dissolved, and at least loosened by the use of hot water. The water should not, however, be used too warm to begin with, or the proteins will be rendered insoluble. By the use of soda the casein is dissolved, and the fat is emulsified. Soda also acts as a poison towards bacteria. Lime is to be preferred for cleansing woodwork, because, if scrubbed in, it will remain for some time, so that its disinfecting action will be prolonged, and it will fill up the pores of the wood and render the surface smooth and firm. The cleaning process must always be finished by a thorough rinsing with plenty of water, either pure or containing one of the chemicals mentioned, or dissolved dirt will remain behind. Tinned or other metal vessels or utensils should, if possible, be boiled or steamed as a final treatment, thus ensuring an extra sterilisation and rapid drying. If they are dipped it is absolutely essential that the water be actually boiling, and they should be immersed for three minutes if the process is to be thoroughly effective.

This last point is very important, for in spite of all reasonable care absolute cleanliness and sterility are seldom achieved, but if only the vessels dry as soon as possible no new growth will develop in them. Wherever possible, the best use should be made of direct sunlight, which both dries and sterilises.

All that has been said as applying to all utensils, piping, &c., applies equally well to the cloths and scrubbing brushes used in cleaning. These must be thoroughly cleaned and finally scalded with boiling water, and dried, to prevent them becoming slimy. Every dairyman should clearly understand that cloths and brushes may do more harm than good if not perfectly clean. It is well known that cleansing cannot be effective if the vessels have inaccessible corners or rough surfaces; frayed woodwork or rusty pails should therefore not be tolerated. To thoroughly clean woodwork it is as well to sometimes wash it with a 1 to 2 per cent. formalin mixture, made by diluting commercial formalin with 20 to 40 times its bulk of water. The most troublesome sources of milk infection are the udder and teats of the cow and the vessels with which the milk comes into contact. Compared with these, contamination from the air plays quite a minor part, but is often quite serious enough to give very bad results.

SUNLIGHT is an excellent germicide, and buildings in which animals are housed should be aligned so that the sun can shine freely into them at some period of the day.

The Control of Infectious Stock Diseases in New South Wales.*

MAX HENRY, M.R.C.V.S., B.V.Sc., Government Veterinary Surgeon.

IN every country in which the livestock industry is of importance, the control of infectious diseases in animals occupies an important place in the activities of the Department of Agriculture, or other department to which such control may be referred. Naturally the conditions in every country vary with the degree of settlement and development which has been attained, with the diseases present, and also with the likelihood that exists of the introduction of further disease. In closely settled countries, such as those of Europe, control has reached a very high stage, but in Australia we are still in the process of evolving the system most suitable to our local conditions.

Further variation is introduced by the differing circumstances which are found in the various States. For instance, measures which would be applicable to Victoria might be impossible in Queensland, and those regarded as sufficient for control in the latter State would really be negligence in Victoria. New South Wales would occupy a position about midway between these States.

The necessary legislation in this State is embodied in the Stock Diseases (Tick) Act of 1901. Under this Act, the Governor is empowered to declare any disease in stock to be a disease to which the provisions of the Act shall apply, and, if necessary, regulations are then drawn up and duly gazetted, laying down the process to be followed with regard to that particular disease. The aim and object of all such legislation is the protection of the flocks and herds of the State, and the restrictions which may be imposed on affected stock are placed thereon for the protection of the surrounding landowners, and the benefit of the State in general. They are, of course, based on scientific knowledge of the disease concerned.

The Diseases to be Controlled.

Australia, fortunately, has so far remained free from the worst of the animal scourges—foot and mouth disease, rinderpest, and many other serious ones such as glanders and rabies. The continued protection of Australia against the introduction of any of these diseases rests with the quarantine service of the Federal Government, which employs as its executive officers the veterinary surgeons of the State Departments of Agriculture. Notwithstanding this good fortune, there exist in this State several serious diseases of livestock that require Governmental control, and those proclaimed under the Stock Diseases (Tick) Act are anthrax, blackleg, pleuro-pneumonia contagiosa, swine fever, swine pneumonia, infestation with cattle tick, tick

* Paper read at the conference of western branches of the Agricultural Bureau held at Parkes on 11th, 12th, and 13th April, 1923.

fever, infestation with sheep lice and sheep tick, tuberculosis, actinomycosis, and cancer. The action to be taken with diseases of so varied natures as these cannot be uniform, but the Act has been wisely drawn up to allow of the necessary variation.

Of all those mentioned, anthrax has undoubtedly taken prior place in the public imagination, and yet at present it cannot be regarded as among those causing the heaviest loss to the State. The chief measures to be adopted against anthrax are quarantine, isolation of in-contact animals, vaccination, and destruction of carcases and any contaminated material by fire or deep burial. The reasons for some of these measures would be obvious to anyone, but some stress may be required on the advice to burn. This is recommended because the main source of anthrax in this State is infected soil—infected by the blood and discharges of a previous case. In other countries, contaminated bonemeal and feed are looked upon as serious sources of infection, but that is not the case in Australia. The measures adopted to control anthrax in Australia have been remarkably successful, but they have been aided considerably by other factors, such as the subdivision of estates and the increase in agriculture.

It is not possible to say much about blackleg for the reason that the disease is remarkable for its elusiveness. It is a soil infection, and in many instances inoculation has been used with good results, but one cannot claim for inoculation in this case the almost uniform success which has been achieved with anthrax. Blackleg is a disease almost entirely confined to cattle, and only found on the coast and tablelands. The danger of the spread of the disease by affected animals is less marked than is the case with most of the other proclaimed diseases.

One of the most dangerous from this aspect is undoubtedly pleuro-pneumonia contagiosa of cattle. Against this disease the Stock Branch is continuously on the warpath. We are confronted with the disease in two aspects, one the enzootic type prevalent around Sydney, and to a lesser extent, Newcastle, and the other the epizootic type, introduced by mobs of travelling cattle from the north. The first necessitates a constant inspection of saleyards and of the herds in the areas mentioned, and the second, watchfulness on the part of the inspectors through whose districts the travelling cattle pass. It is here convenient to note one method of control, not only in connection with this disease but with others also—the close co-operation which exists between the veterinary staff of the Metropolitan Meat Industry Board and the Stock Branch. At times the first intimation of an outbreak is the finding of an affected animal at the abattoirs. Such an occurrence leads to prompt inspection of the herd from which the animal comes. As regards cattle from the north, as soon as they cross the border notice is sent to all inspectors on the route the cattle are to follow, and in the case of cattle moving after the termination of their period of quarantine, special notice is forwarded to the inspectors. Once an outbreak is located the cattle and holding are quarantined, affected animals destroyed, and the in-contacts inoculated.

It has been found that one of the worst factors in disseminating pleuro-pneumonia is the so-called recovered animal. It is doubtful if a real recovery ever takes place, but many apparent recoveries do occur, and animals that appear to become healthy carry a chronic lesion in the lung, which, under the stress of travelling, calving, or other exhausting circumstances, may become active and provide the focus for a fresh outbreak.

It is hoped now that Glenfield Veterinary Experiment Station has been completed, and a highly qualified veterinary pathologist, in the person of Dr. H. R. Seddon, D.V.Sc., has been appointed, that we shall be able to utilise some of the more delicate tests for pleuro-pneumonia, the application of which would materially conduce to more efficient control.

Turning for a moment to the pig, we have to consider the action taken in regard to two very serious diseases, swine fever and swine pneumonia. The first is without doubt the most serious complaint of pigs known, and has in many countries caused very heavy loss. It was introduced into the State some thirty years ago and spread somewhat rapidly, but was eventually controlled, and gradually, in spite of one or two serious recurrences, it has been got under control. It is now some time since an outbreak of swine fever occurred in the State, and although complete future immunity cannot be expected, yet, it may be hoped that should recurrence occur it will be held, as it was last time, in a restricted area. In countries where swine fever is widespread and constantly present, vaccination is employed to control it, but where, as in New South Wales, it only occurs at long intervals and is confined in location, vaccination would be an unwise policy, as a vaccinated pig may be a source of infection and may lead to the starting up of the disease in other places. One inspector is continually kept on duty in the pig-feeding areas around Sydney, and the inspectorial staff at the abattoirs are continually on the watch.

Swine pneumonia has only recently been added to the list of proclaimed diseases. It was added because we found that losses were becoming rather heavy, and there was evidence of the spread of infection by diseased pigs—a spread which the Department was powerless to prevent. Now, action can be taken and the holding quarantined. It must be confessed that much remains to be learnt about swine pneumonia - several types are found in the State.

The next two diseases on the list are associated with the presence of parasites. One, the cattle tick, represents the greatest menace which the cattle owners of this State are facing, and the battle against it is being waged in the north-east corner of the State, and along the Queensland border. Unless one is acquainted with the cattle tick and what it is capable of doing, both through tick worry and by the introduction and spread of tick fever, it may be difficult for stockowners to grasp the importance of the question. There is no natural check to the spread of tick in New South Wales, except in the far west; it was only the snow line and desert which stopped its progress in North America. New South Wales has done what no other country has succeeded in doing—it has held the tick in the

absence of such natural checks; but the parasite could not altogether be stopped and it has moved very slowly southward. It is time now for the State to turn its hand to the bigger work, and eradicate it. The only method of dealing with the tick is by dipping, and the most effective dip so far discovered is an arsenic preparation. In addition, it is necessary to control strictly the movement of stock within the tick infested areas, and to be very strict with regard to the stock permitted to leave those areas.

The line of action to be taken against the sheep louse and sheep tick is absolutely different to that taken against cattle tick, for, in this case, there is no highly fatal disease to be considered. The question of control is by no means unimportant, as serious louse infestation means serious economic loss. The regulations are so drawn up as to allow of local variation, and when applied with vigour have been found of distinct value in minimising the evil effects of the pest. Again, dipping is the main agent employed, and again the arsenical preparations are the most suitable. One aspect of the campaign against lice has not been sufficiently considered, and that is the construction of sheep dips by local authorities, or on a co-operative basis by bodies of farmers. Compulsory dipping was seriously considered, but its drawbacks are many, and the principal one is the difficulty of making compulsory dipping reliable and efficient.

The last three diseases noted on the list are placed together, as they differ from those previously noted in being chronic complaints which do not appear in epizootic or acutely infectious forms. One of them, tuberculosis, is certainly one of the most serious diseases from which stock suffer, not only because of the loss in stock, but because of the danger of the transmission of the disease to mankind, particularly to children. With the staff and facilities at its disposal, the Stock Branch can do little more than deal with such cases of tuberculosis as are brought to its notice, or may be seen in saleyards, and so on. Certainly the Government herds are kept clean, but much more is required. In many countries progressive efforts are being made to eradicate the disease from herds supplying milk to the cities; for instance, in the United States and Canada, what is known as an "accredited herd" system has been built up, the basis of which is the testing by Government veterinarians, and the consequent eradication of the disease from that herd. Once clean, the herd is passed over to the care of the dairy farmer's private veterinary surgeon. In England many of the big cities take steps to ensure the purity of their milk, and if tubercle bacilli are discovered in any supply, the cattle of the farm from which it comes are specially examined by the city veterinarian. Denmark instituted a country-wide campaign against the disease, somewhat on a co-operative basis, enlisting the active assistance of the farmers' co-operative societies and their veterinary surgeons. There is no doubt that much economic saving would ultimately result from such activities as these, not only from the saving of life amongst cattle, but also amongst pigs, since nearly all the tuberculosis in pigs is the result of infection from cattle.

Against actinomycosis no action is required except to destroy cases in an infective state whenever found, and large numbers of such animals are annually dealt with by the officers of the Stock Branch. Cancer, which is not an infectious disease but is serious to the animal attacked, is dealt with by slaughter, if incurable.

This brief outline of the activities of the Stock Branch with regard to the control of disease is intended to make two or three points clear. Firstly, it s evident that unless stockowners co-operate with the Branch, control is likely to be inefficient, for unless the people concerned really appreciate the necessity or desirability of the action taken, it cannot well succeed. I do not think there is any doubt that the progressive stockowner is not only with the Department in its efforts, but would really like to see those efforts extended. Secondly, the different Departments dealing with live stock in various phases, must co-operate. Thirdly, more research work must be carried out to devise better tests, better methods of diagnosis, and better systems of control.

How to Make a "Starter."

To make a commercial starter for use in butter factories from a pure culture place one quart of fresh or separated sweet and clean milk in a sterile jug, free from chips, or in a glass jar. Heat the milk gradually by allowing the jug or jar to stand in a vessel of boiling water until a temperature of at least 200 deg. Fah. is reached, and hold at this temperature for not less than half an hour. Cover the jug or jar with several thicknesses of cheese cloth (recently boiled and wrung), and allow it to cool by standing it in cold water. If a glass jar is used care must be taken not to place it suddenly in cold water or it will crack. As soon as the temperature of 75 deg. Fah. is reached shake the bottle containing the ferment, carefully remove the cork with a sterilised penknife or other instrument, then raise the covering cheese cloth slightly and pour the contents of the bottle carefully into the cooled milk.

Stir the mixture slightly with a sterilised metal or glass instrument, put away in a quiet room, and hold at a temperature of about 70 deg. to 75 deg. Fah. for about twenty-four hours and until the milk thickens. The culture may be slow at first, owing to the development of excess lactic acid (formed during transit), and it may be necessary to repeat the process just described until a vigorous "mother starter" is obtained.

After obtaining a vigorous mother starter take 8 or 10 gallons of sweet clean skim milk in a previously sterilised milk can that is free from rust or rough surfaces, and sterilise and cool as previously described. When the milk in the can is cool (about ·70 degrees Fah.) add the quart of mother starter and stir with a sterilised metal instrument. Then put away, covered with a clean cheese cloth of several thicknesses, in a quiet room, and hold at a temperature of 70 degrees Fah. for eighteen to twenty-four hours, when it should be coagulated. A small amount of this is used to inoculate the starter for the following day.

This may be used at the rate of from 2 per cent. to 5 per cent. of the cream to be inoculated.—O. C. Ballhausen, Assistant Dairy Expert.

Forestry.

Its Relation to Agriculture and the State.

J. J. McLEOD, Assistant Forester.*

Like agriculture, forestry is one of the great national opportunities and duties that lie before us, and with respect to both we must develop a civic pride and arouse interest if we are to make Australia prosperous and secure. Agriculture, by reason of its early maturity and the consequent gathering of yields at short intervals may be considered as essentially the business of the private individual. But forestry may more appropriately be considered the business of the State, because of the long periods necessary to bring the timber crops to maturity, and because consideration has not only to be given to the present generation, but to future generations.

You will agree that it is necessary for a nation to have an adequate and regular supply of timber and forest products; indeed, there is scarcely any branch of human activity, or any period throughout the life of a man into which the produce of the forest does not enter in some form or another, and hence ample timber supplies are essential to modern, civilised existence.

Agriculture and forestry have much in common. They both supply the raw material on which other industries depend; they both provide extensive employment on the land—the agriculturist needs timber for his buildings, his furniture, fencing and fuel, while the forester needs agricultural produce to supply him with the necessaries of existence; they both need population to utilise their products and good roads to bring them to market; they are both primary producers. Like agriculture, forestry should be a great, national, rural industry and a source of never-failing wealth and health to the people.

A perfect forest is rarely found in nature, the principal reason being that a virgin forest is largely stocked with over-mature trees, the accumulated growth of centuries. These are nearly always faulty and defective. It is the forester's province, by method and system, to manage and improve nature's plan by cultivating and protecting the maturing crop, and to see that utilisation and felling are performed in such a way as not to interfere with or retard the permanent productivity of the forest.

The Establishment of a Forest.

In selecting land for forestry purposes, a deep moist soil should be chosen. Subsoil moisture and drainage are the first essentials for a good growth of timber; quality of soil is less important in forestry than in agriculture, as to a great extent the forest will make and keep its own soil.

* Paper read at a recent meeting of the Freeman's Reach branch of the Agricultural Bureau.

Accessibility to railways and roadways is important, as timber is the heaviest crop that the soil produces, and transport over long distances is costly. When land has been chosen for afforestation purposes, or for the management of an existing stand, it should become in perpetuity a national State forest.

In this young country we have yet millions of acres of hardwood forests, and instead of considering schemes of afforesting new areas with eucalypts, we might with advantage give attention to the proper management, protection and silvicultural treatment of those areas of forest land which still remain the property of the people. It is a mistake to think that exploitation and cutting will destroy or ruin a forest. Judicious felling combined with regenerative treatment will make one acre of forest yield as much as five do now under natural conditions. In dealing with this class of forest it is all-important to ascertain the annual volume of growth per acre, and care should be taken not to extract or harvest more than that quantity, otherwise the forest will soon become depleted and considerably damaged. This annual increment or volume of growth is the forest's yield; and in properly managed forests it will be available for harvesting each year or period of rotation until time shall be no more. We must regard our forests as we regard our wheat fields, as crops ripening to maturity. The ripened crop must be garnered at the proper time, else loss and damage will result. That an annual rotation in the one case becomes a rotation of a generation or so in the other is merely a matter of degree. Under proper treatment the annual increment or rate of growth of a forest can be enormously increased. This increased productivity is the aim of the silviculturist.

A wild virgin forest contains alike, valuable timber and a vast store of over-mature and hollow trees, and other growths of no commercial value—it is too often only a skeleton of what it should be. In this uncultivated condition, as a rule, there is no annual rate of growth; the losses caused by decay and deterioration of mature trees, and the destruction and damage by fire to seedlings and growing trees, equals and, in many cases, far exceeds the annual growth of the forest. The cultivated forest is the ideal of modern scientific forestry—its object is to transform the wild, unproductive forest into the highly productive, permanent one that ensures a continuous and sustained yield for all time. Now, to attain this object it is necessary to place each forest under a working plan or scheme of management which will provide for its protection, exploitation, and regenerative treatment over long periods of time. First, consideration should be given to the extraction and utilisation of mature and over-mature trees, and the elimination and destruction of all waste and useless growths, so there shall remain only trees of various ages ripening towards economic value. The forest will then require a period of rest, and the floor of the area treated will be comparatively clean and in a suitable condition for the reception and germination of seed. A poorly or half-stocked forest is most undesirable, and will not produce good timber or a satisfactory volume of annual growth.

Thus the working plan or management scheme will have for its object the conversion of a wild, irregular, natural forest into one of great economic value by regularisation, fire protection and silvicultural improvement. In a short period the unproductive natural forest will be transformed into a cultivated forest, and remain for all time in this productive condition, the timber always being cut and the cutting so arranged that the forest is continually improved. The working plan is the most important part of early forest management—in it the history of the forest is recorded. One must remember that the life of a man is as nothing compared to the life of a forest. In applying systematic management to the natural forest or wild wood, the working plan should indicate the extent of organisation required—timber assessments, topographical surveys, subdivision into compartments, fire protection, fire breaks and lines, construction of dwellings, fences, roads and bridges, water conservation, grazing, &c. Management schemes and specifications of improvement and protection should be made to apply over long periods of time without change of policy; in fact, we come here to what is really the keystone of forestry, *i.e.*, continuity—whether of production, employment, or of management.

Timber is a crop capable of reproduction, and not a mine that is bound to be exhausted. Forests can be perpetuated for use. Under proper management virgin areas are not exhausted or cut out by utilisation, but are treated so that they give a permanent yield and one that is in almost every instance, greater than was formerly the case.

Softwood Culture.

I would now like to come to the matter of softwood culture. Our principal softwoods are the cypress pines of the west and the hoop pine of the northern coastal region, but these are totally inadequate to meet our requirements, as is shown by the fact that we are spending £1,500,000 each year in the purchase of softwoods from abroad. Taking into consideration our present rate of increase in population, and an anticipated corresponding increase in manufacturing industries, it is probable that at the end of a period of thirty years it will be found that a sum of from £4,000,000 to £5,000,000 will be sent out of the State each year for the purchase of softwoods in other countries. The bulk of this imported timber comes from artificial or cultivated forests, which have been planted, grown and converted by foresters and forest workmen in other lands. It is a simple question whether the cultivated forest and the population it supports should be here or elsewhere. The timber can be grown as well in New South Wales as in the Baltic countries or in America.

Our hardwood forests are very valuable, but they would have been many times more valuable had they been softwood instead of hardwood. It is a mistake to think that hardwoods are the most useful. Timber users must have softwood, and it is a significant fact that nine-tenths of the timber cut in the world is softwood. What a vast store of wealth we would have had,

richer than any of our gold-fields, had nature clothed the mountain country between here and Lithgow and extending to our southern highlands beyond Mittagong and Moss Vale, with dense coniferous forests! If instead of struggling eucalyptus trees, these mountain hillsides, ranges and spurs contained the dense pine forests of other countries, it would have represented an asset of untold wealth, and made easier the task of those who have to arrange our State finances.

The Introduction of Foreign Species.

When we come to the question of the introduction and establishment of exotic softwood trees in our forests, we come to a proposition pregnant with possibilities for increasing the capacity of the State to eventually support in affluence, a much greater population than would ever be the case if this matter were to be neglected. Most of our cereals, edible fruits, root crops, and grasses have been introduced from other countries, and by careful husbandry have reached a state of perfection equal, if not superior, to that which obtained in the countries from which they were imported. So with regard to trees, eminent foresters are certain that the most valuable trees for our forests are not those which are in them at present, but those which will be introduced into them from other lands by scientific forestry.

Experience has proved that many European and American timber trees make a more rapid and better growth in Australian soil, and under Australian conditions, than they do in their natural habitat. One might here refer to the Californian *Pinus insignis*, which is said to be a better tree everywhere in Australia and New Zealand than in its own country. We have a wide area of highland country now carrying a sparse and stunted crop of indigenous trees, the present growth of which is, perhaps, the result of centuries of an unequal struggle against unsuitable conditions. If we would endeavour to re-afforest this land with indigenous softwoods, our efforts would no doubt fail. On the other hand, if we used types peculiar to other lands, such as the Insignis pine, the Cluster pine, and many others, our efforts would be crowned with success, and the rate of growth would be so rapid that we would be able to harvest the matured crop in a period of about thirty years, as against a period of from ninety to one hundred years in the case of the indigenous kinds.

The laying down of a coniferous plantation is not a spasmodic effort at planting, but the continuous rotational use of land so that a perpetual supply of timber will be produced; for example, if we were dealing with an area of 3,000 acres and were planting a species that would mature in a period of thirty years, we would plant that area by thirty annual plantings of 100 acres each. At the end of thirty years the first 100 acres planted would be harvested, and each year thereafter for all time 100 acres would be harvested and a similar area planted. As in the case of hardwoods, managerial schemes or working plans are necessary, providing for the subdivision of the land into suitable working compartments, laying out future extraction roads, fire

protection, and accommodation for men, &c., and the continual raising of ample nursery stock. In the early stages, crowded culture is necessary in order to induce an upright, rather than a lateral habit of growth, resulting in long, straight boles, which are essential for the production of good timber. Usually 800 to 1,200 young trees to the acre are put out into the field, and the plants are spaced 6 to 8 feet apart.

The Return to the State.

On the question of expenditure and anticipated profit I would submit, as an illustration of what might be expected, the following figures. Taking, for example, a thirty-year rotation, the cost of planting, maintenance, harvesting, and interest on money expended, would probably amount to £85 per acre. A conservative estimate of the yield would be 100,000 superficial feet per acre. The sale value of this timber at 5s. per 100 superficial feet would be £250 per acre, showing a nett profit of £165 per acre. or an annual profit of a little over £5 per acre during the rotation. Thus it will be seen that although money so expended is not immediately returned, the actual returns will abundantly recoup the outlay, and it can be safely regarded as a good reproductive investment.

The story of the early history and development of forestry and tree culture in this State is not an attractive one, and on the whole it is a sad story of destruction and spoilation; but I have no desire to discuss this aspect; rather would I point with pride to the progress and results that are now being achieved—to the hundreds of thousands of acres that are now being brought under a working plan and scientifically and systematically treated; to the numerous pine plantations that have been established throughout the State, and that are beginning to rear their dark heads above the soil. During the last planting season, over a million young trees were planted out in my district alone.

Before concluding, I would like to appeal to you all, as landholders, to improve your holdings by each year planting out a hundred or so young Insignis or Cluster pine trees, either as timber plots, shelter clumps, or windbreaks.

Eight Aims for the Co-operator.

Co-operation is not a "get-rich-quick" method, nor a panacea for all the ills of the business side of farming. Co-operative combinations of farmers can be usefully formed to achieve the following objects:—

To obtain better value for produce.
To improve the quality and appearance of produce.
To cut out all unnecessary middlemen's profits.
To break up rings.
To cheapen purchases and insurance.
To facilitate the obtaining of credit.
To create markets and to steady them.
To make possible the utilisation of the best machinery and sires.

—A.I.F. Education Service, Land Book No. 3.

"Sour-sap" of Fruit Trees.

Some Records of its Occurrence, and Experiments for its Control.

W. A. BIRMINGHAM, Assistant Biologist.*

In 1918, Orchard Inspector W. H. Waters, Burradoo, reported that, at Elderslie, Camden, he had found that growers were troubled with a disease of peaches (principally), plums, and apricots, that attacked trees of all ages from about 4 years upwards; and that trees, growing in different soils, varying from pure sand to heavy clay, were all susceptible to the disease. The characteristics of the disease were—(1) trees died right down to where worked—the stock and root almost invariably being sound, even in the small fibrous roots; (2) a peculiar sour smell emanated from the dead and dying wood when cut; (3) no apparent fungus or insect pest was present.

At the end of 1918 apple trees in the Camden district were reported to be attacked by fire-blight. The bacterial disease fire-blight, due to *Bacillus amylovorus*, was not known in this State at that time, nor has it been recorded since. An investigation of the condition of the apple trees in the field, and an examination of selected material microscopically in the laboratory, lead to the following conclusions:—

1. The condition was not due to any organism, therefore not infectious.
2. The condition appeared to be due to some physiological disturbance.
3. The type of soil appeared to play no part in the trouble, as it was not confined to any particular soil, but was found on sandy, alluvial, and heavy clay soils.
4. That the two previous seasons, which were exceptionally wet, may have contributed to the condition.
5. That the condition closely resembled sour-sap.

It was suggested that growers should adopt the name of sour-sap† for this disease in preference to fire-blight, in order that it may not be confounded with the American disease of that name.

During January, 1919, the disease was found in apple, peach, and apricot trees at Coonabarabran, and in November, 1920, sour-sap was detected in pear trees at Kurrajong, where numbers of the buds failed to come away,

* I sincerely regret the loss, by death, of my late colleague and collaborator, Charles Oswald Hamblin, Principal Assistant Biologist, during the progress of the experiments. It was on his recommendation that the soil tests were carried out, and that attempts were made to transmit the disease from affected to healthy trees by means of buds and strips of cambium.

† "Sour-sap" has been known in America and New Zealand for many years. After careful examination and observation had been made it was concluded that the disease was identical with that in America and New Zealand.

and the foliage was small and scanty. The condition was generally uniform throughout the trees, with one or two exceptions. The root systems appeared normal in the field. Heavy rains had been experienced, followed by several months of dry weather. The cultivation appeared to have been good. Drainage was not good on the areas where the trees were affected, he subsoil being of a clayey nature.

Orchard Inspector A. T. Hunter, in December, 1920, reported sour-sap in apple trees to be very prevalent throughout his district. A large number of trees succumbed to the disease, particularly Granny Smith and Trevitt Seedling, and some blocks of Carringtons. The disease had not been noticed to be so severe in previous seasons.

Apple Tree (Granny Smith) affected by Sour-sap

At the end of 1920, sour-sap was reported to be worse in Granny Smiths in the orchard at Camden previously referred to, and to be extending to other varieties. An inspection was made, and the disease was found to be more pronounced and attacking other varieties not previously recorded in this orchard.

A Control Experiment.

After consultation with Mr. C. O. Hamblin, the following experiments were recommended, approved, and put in hand at Camden :—

1. Three trees to be treated with 30 lb. freshly slaked lime per tree, to be followed by a generous dressing of well-rotted farmyard manure a fortnight later.

2. Three trees to be treated with 30 lb. freshly slaked lime.
3. Three trees to receive a generous dressing of well-rotted farm manure.
4. Three trees to receive a dressing of ¾ lb. nitrate of soda.
5. Three trees to receive a dressing of 2 lb. muriate of potash.
6. Three trees to receive a dressing of 2 lb. sulphate of iron.

Before the applications were made soil was taken 1 to 2 feet under the surface adjacent to affected trees and tested for acidity and nitrogen content by the Department's Chemist, with the following result:—Reaction of soil, acid – nitrogen ·098 per cent. N, equal to ·119 per cent. ammonia.

The Chemist remarked: "The sample is not rich in nitrogen, but not abnormally low."

Apple Tree (Granny Smith) in an advanced stage of Sour-sap.

Four applications as above were made one each in March and July, 1921, and January and July, 1922—by Orchard Inspector Waters, on trees growing on alluvial flats, the drainage being good. Careful examination of a number of trees failed to reveal the presence of any parasitic organism. Roots of affected trees, when freshly dug, appeared normal to the unaided eye. Examined microscopically, the presence of gum was found throughout the tissues, in some cases the sap-conducting vessels being partially choked with it. Disorganisation of the cambium layer was generally noticeable.

In November, 1921, samples of soil were taken from four trees (two of which had been dressed with farmyard manure and two with sulphate of

iron), 3 to 5 inches and 1 foot below the surface. Mr. J. K. Taylor, School of Agriculture, University of Sydney, kindly offered to carry out the hydrogen-ion determinations. Duplicate samples were submitted to the Chemist of the Department for determination of the nitrogen content.

Mr. Taylor reported:—"All the Camden soils range from Ph 6·4 to 6·8, and, consequently, are nearly neutral in reaction." The Chemist reported regarding the determination of the nitrogen content: "I understand that trees Nos. 8 and 9 received the addition of nitrogenous manures, and in comparison with 'good and bad trees untreated,' these show a very slight increase in nitrogen content.

"This increase is, however, very small indeed, and it appears from this series of experiments that there is no connection between sour-sap and the nitrogen content of the soil."

Peach Tree (Braddock's) affected by Sour-sap.

The treated trees were examined on 4th May, 1922, but showed no perceptible improvement, nor did any show up to two years from treatment, when the experiment was discontinued.

Orchard Inspector H. A. Wood, Richmond, reported in January, 1922, that large numbers of peach trees were dying from no apparent cause, 6 acres of 9-year old trees of various varieties being affected in one orchard. Inspector Wood gave the symptoms as follows:—

"The trouble appears first in the heads of the trees, sometimes affecting only one limb, other times more, but gradually extending over the whole tree; the roots are apparently normal.

"When the heads of the trees die down to the base, they make another growth which seldom lasts over a season or two."

These trees were inspected by the writer, who found that the condition was typical sour-sap. Samples of soils were taken from two bad and two apparently healthy trees, 3 to 5 inches and 1 foot below the surface, and submitted to the Chemist of the Department, who reported: "There is certainly a difference between the average nitrogen content of good tree soil (·117) and that of bad tree soil (·082) in samples submitted. As the average of all county of Cumberland soils is about ·09 per cent. nitrogen, and that of typical virgin soils in Cumberland is ·13 per cent. nitrogen, there appears to be no reason to think that the amounts found in soils round 'bad trees' are responsible for the condition of sour-sap."

Peach Tree (Governor Rawson) in an advanced stage of Sour-sap.

During the current season sour-sap was found at the Kentucky Soldiers' Settlement, and some acres of peach trees in the Windsor district succumbed to the disease.

Sour-sap of stone and pome fruits has probably affected isolated trees and patches of trees for many years, but was not connected with that disease, being popularly known by growers as fire-blight. Its cause is not known. Extreme and fluctuating weather conditions have been suggested as a possible cause, but although the condition in New South Wales appears to be associated in some cases with extreme weather conditions, this is not always the case. As an example, in two large apple orchards in the Camden

district, all the conditions of which are comparable, all varieties in one place are more or less affected, while on the other there is no indication of the disease. Both of these orchards are subject to the same weather conditions.

Nitrogen starvation has also been put forward as the cause. Our own observations and experiments do not support this view

The Varieties Susceptible.

Through the Officer-in-Charge of the Exports and Imports Branch of the Department, it was arranged for the Orchard Inspectors to supply a list of the fruit trees and varieties affected with sour-sap in their respective districts. The following is a list, compiled from the different reports:—

Apples.—Granny Smith, Fanny (Pomme de Neige), Trevitt Seedling, Frampton, Gravenstein (Carpenter), Carrington, London Pippin, Jonathan, Fameuse, Reinette de Canada, Russet, Mobbs' Royal, Middle Smith, Allsopp's Early, Lord Nelson, Irish Peach, Aiken's Seedling.

Pears.—Williams, Packham's Triumph, Josephine de Malines.

Peaches.—Elberta, Briggs' Red May, Hales' Early Triumph, Aunt Becky, Christmas Box, Braddock's, Admiral Dewey, Devlin's Red, Globe, Chair's Choice, McDevitt's Cling, Californian Cling, Red Italian.

Nectarine.—Goldmine.

Apricots.—Varieties not known.

The Symptoms of Sour-sap.

As a result of observations in the field the following symptoms may be said to be typical of sour-sap. In spring, many buds on one or more branches fail to leaf out; if they do, the growth is very poor and scanty. Owing to the lack of foliage affected limbs become scalded by the sun. The bark may become reddish-brown in colour and may later become blackened, due to invasion by saprophytic* fungi. This condition may be confined to one or more branches, or, in some cases may be general throughout the tree. The affected part of trees is not peculiar to any particular aspect.

On cutting the bark of some limbs that have recently died, a sour fermenting smell is noticeable. Diseased trees will often make new growth in the centre from the main branches, or sucker up from the base.

In stone fruit trees, the disease can often be clearly traced by a slightly elevated ridge running down the branch. On cutting through this ridge it will be seen that it is the junction of diseased and apparently healthy tissue.

Trees, once they are badly affected, seldom make more than a partial recovery.

The roots of affected trees when dug up appear normal, but when cut may show, on careful examination, the presence of a brownish discolouration in parts. This is due to the presence of gum in the tissues, but can only be definitely determined microscopically.

* Saprophytic—living on dead organic matter.

Summary.

1. There is no evidence so far to support the idea that the disease is due to an organism. All attempts to isolate a causal organism have failed.
2. The condition appears to be due to some physiological disturbance.
3. There is no evidence to support the opinion that the soil is responsible. Sour-sap is to be found on all types of soil—sandy, alluvial, and clay.
4. The Granny Smith variety of apple, appears to be more susceptible in some cases than other varieties.
5. There is some evidence to support the view that the disease may be associated with extreme weather conditions. Two outbreaks—one in apples, and one in peach trees—followed on periods of excessive rainfall.
6. Analyses of soils adjacent to affected trees indicate that soil acidity is not responsible.
7. Nitrogen starvation is not indicated by soil analyses. The addition of nitrogenous manure, as farmyard manure and nitrate of soda, to the soil, has effected no improvement in diseased trees.
8. Treated trees have failed to respond to dressings of lime, and also lime followed by farmyard manure.
9. The presence of the disease in trees growing on well-drained soil indicates that lack of drainage is not altogether responsible.

In addition to the name sour-sap, this disease is also known in America as "winter-kill" or "spring-injury."

I am greatly indebted to Orchard Inspector Waters for the interest he took in carrying out the experiment at Camden, and also to the staff of inspectors generally. To the growers who co-operated with the Department in carrying out the tests, I offer thanks, and the assistance given by Mr. J. K. Taylor, Agricultural School, University of Sydney, and the officers of the Chemist's and Fruit branches is greatly appreciated.

The Physical Properties of Soils.

It is generally recognised that the chief physical properties of a soil affecting plant growth are moisture, aeration, temperature, texture and tilth. The moisture content is affected by drainage in the rainy season and by keeping a loose surface free from weeds in the dry season. Since the free air space in a soil is that space not occupied by water it follows that aeration is dependent on moisture control. The factor most under control is tilth.

After land has been beaten down by rain its volume weight is increased from the well-tilled condition brought about by cultivation. The difference is strikingly seen when the height of an area which has been hoed or ploughed is compared with that of the landside. This loose condition is called tilth and results from the formation of complex crumbs between which there are air spaces. In nature tillage is kept by means of a network of roots, and the upper surface of the soil is protected from beating rain by a layer of fallen leaves.—C. R. Harler, B.Sc., A.I.C., in the *Quarterly Journal* of the Scientific Department of the Indian Tea Association.

A Record of Co-operative Effort in Relation to Local Fruitgrowing.

ALTHOUGH the statement that the future prosperity of our fruitgrowing industry will depend largely upon the attitude of orchardists toward co-operation has become something of a platitude, its essential truth is one of which the fruitgrower can scarcely be reminded too often. Probably the number of orchardists who would nowadays seriously question the benefits of co-operation is comparatively small. Unfortunately, however, a substantial proportion of our growers seem to have arrived at a lukewarm acceptance of co-operation as a general principle and a disinclination to press matters beyond that point.

New South Wales fruitgrowers can, nevertheless, point to a certain amount of co-operative progress of a practical kind. Compared with the advance yet to be made, it has been as inches compared with miles, but there are certain far-sighted communities of fruitgrowers who are making an effort to tackle in a rational way the problems that beset their industry. It is impossible to do justice in the present article to their individual activities in detail, but a summary of information supplied by the more important co-operative fruitgrowers' concerns will afford some idea of the position of co-operation in relation to our fruitgrowing industry to-day.

Most of the existing fruitgrowers' co-operative organisations tend to specialise in some particular class of fruit. This tendency is, of course, perfectly natural, seeing that the organisations have usually come into being to serve the needs of particular communities, situated in localities suited to more or less distinct types of orcharding. There is a great deal to be said for specialisation as a deliberate principle in this connection, as American orchardists, with their huge citrus growers', walnut growers', and other organisations have proved. Organisations such as these have not contented themselves with supplying the existing demand for the products they handle, but by masterly use of the art of advertisement they have enormously increased the demand. Such activities call for substantial financial resources, and mark a stage at which local co-operation has not yet arrived; but it may be anticipated that as the fruitgrowers of this State come to realise the avenues which co-operative methods can open up to them opportunities of such significance will not be overlooked.

It is in relation to the grading, packing, and marketing of his product that co-operative methods can perform for the fruitgrower perhaps their greatest service. Co-operative purchase is, of course, also an essentially sound principle—in fact, the initial efforts of many successful farmers' co-operative associations have been on those lines, and in several sound organisations it

remains a cardinal aim—but it can safely be said that in no branch of the fruitgrowing business is there such serious leakage of profits as in the disposal of the product.

Gosford Citrus Growers' Profit by Co-operative Packing.

In this connection the operations of the organisation representative of the most progressive citrus growers in the Gosford district may be referred to first. The membership of the Citrus Growers' Association of New South Wales comprises only *bona fide* growers who send their fruit to the association's packing house. The association is purely co-operative, and after deducting the expenses for the season, all moneys remaining are paid out to growers in ratio to the fruit sent in by them. This season the Association has confined itself principally to the improvement of the pack by standardisation. Upon the receipt of the fruit, it is first graded for quality, then for size, and the pack for the whole season is strictly supervised and kept uniform. By these means the Association claims to have obtained an average of over a shilling a case better prices than for fruit packed under independent conditions, and it is anticipated that the prices for Valencia oranges will turn out two shillings above the independently packed average.

The Association has not been operating very long, but already its pack has become known, and orders have been received from all over New South Wales and from Queensland. Owing to this wide range of demand, the Association has been able to keep a fair amount of fruit off the Sydney market, thus helping to reduce the chance of gluts, as well as obtaining the highest prices for its members. Says the secretary: "As the movement grows, as it shows every promise of doing in this district, and as we have more fruit to handle, the more influence will we have in avoiding gluts, which, together with the marketing of bad fruit and poor packing, are the main reasons for poor prices."

By close supervision and constant contact with agents, this Association has effected considerable savings in connection with empty cases returned from the market. Losses under this heading so far this season, it is stated, have not been 1 per cent. The contention that no ordinary grower can even approach this figure is a fair one.

That Gosford citrus growers generally are beginning to appreciate the full financial force of the co-operative argument is expressed in the fact that, given an ordinary season, the Association expects to handle at least four times as much fruit next year as during the past season.

Irrigation Plus Co-operation.

The Murrumbidgee settlements have for long illustrated what the drier portions of New South Wales are capable of producing when periodically supplied with water, and for a couple of years now a Leeton organisation has been showing what irrigation plus co-operation can accomplish.

The Murrumbidgee Irrigation Areas Co-operative Company, Limited, was formed in January, 1921, and was originally promoted chiefly for the purpose

of drying, grading, and packing apricots, peaches, and grapes for its members, the proceeds from the sale of the fruit, minus expenses and cost of processing, being paid to the growers according to the quantity and grade of the product delivered. The company now undertakes to pack and market fresh fruit for its members. Only a portion of the fruit is sent to the agents in Sydney, a large quantity being sold direct to country fruiterers, with whom the company has established a substantial connection. During the citrus season the company caters for the crops of oranges and lemons, and some 12,000 bushels were exported to England and Canada during the season recently completed. About 150 tons of lemons were also sold, principally for the manufacture of squash and candied peel. A number of agencies for such lines as implements, harness, vehicles, spraying materials, fertilisers, &c., have also been accepted by this company as an additional source of revenue.

The problems that beset the path of any co-operative association are many, and in the case of the Murrumbidgee company an important obstacle has been the difficulty of competing on equal financial terms with the outside speculator.

"The advantages to be gained by unanimity in respect to co-operation are obvious, but it is difficult to convince the growers," says the association's secretary. "Fruitgrowers, like other primary producers, are naturally anxious to receive the returns for their products in cash, and with dried products the length of time taken in disposal causes growers considerable inconvenience. As is the case with most co-operative companies, our capital is very limited, and we are not in a position to buy fruit right out from the growers. This fact makes it easy for speculators to purchase fruit from growers at prices which are much lower than could be obtained under the co-operative system of marketing."

What Banana Growers are Doing.

The get-together movement among the banana growers of the State finds its expression in the Tweed Fruitgrowers' Co-operative Company, Limited, a company established primarily with the object of supplying growers' requirements in the way of cases, nails, fertilisers, &c., and arranging and facilitating transport. Until about a year ago its activities were confined largely to the Lower Tweed, but it had long been recognised that there should be closer co-operation between the whole of the banana growers in New South Wales, and conferences between the various growers' organisations from the Tweed to the Richmond led to the adoption of a general marketing scheme controlled by the company and accepted by a large number of growers throughout the banana-producing areas of the State.

The original scheme provided for the control of distribution and marketing, but the disinclination of a large number of growers to submit to any system of control militated against its success; and the principle underlying such agreements having been made the subject of a legal issue and the agreements

ruled invalid, a modified marketing scheme was ultimately adopted. The policy of the company is the concentration of sales in the hands of a limited number of agents, and certain agents (twelve in Sydney and two in Melbourne) are appointed to handle the whole of the fruit entrusted to the company. A representative has been appointed in Sydney who receives and supervises the distribution of fruit in that centre, and who also makes sales direct on behalf of the growers who so desire. Returns for all fruit handled by the company, whether sold direct or by agents, are received by the company, which furnishes individual accounts sales to the consignors. During the six months ending November, 1922, approximately 65,000 cases were sold through the company—about one-third of the bananas produced in the State.

Sydney is the principal market for the Tweed bananas, and from three-fourths to four-fifths of the crop is shipped to market by steamer, under consignment by individual growers. The bulk of the fruit on the Lower Tweed is railed from Tweed Heads *via* Wallangarra by special fruit trains arranged by the company in conjunction with a southern Queensland fruitgrowers' organisation. The loading and consignment at Tweed Heads is carried out by the company, and the fruit is delivered to its representatives in Sydney and Melbourne, all freights and cartage being prepaid by the company and recovered from returns as received from the selling agents.

For the convenience of members, the company carries stocks of certain necessary commodities, the annual trading turnover amounting to £20,000. The cases are purchased in large quantities from Queensland mills, and nails are purchased direct from the manufacturers, so that intermediate profits are eliminated as far as possible. During the last three years some 150,000 banana plants have been procured from Queensland for growers who would have found it impossible to obtain them individually. In many ways growers find the trading activities of the company a decided advantage.

Another Company on the Irrigation Area.

Another co-operative association, the members of which are located on the Murrumbidgee irrigation area, is the Griffith Producers' Co-operative Company, Limited. This company, the fruit section of which is naturally of greatest significance, was formed in 1921, and registered as a limited liability company with a capital of £50,000 for the purpose of handling the primary products of the Mirrool area. Its shareholding is restricted to producers at the present time, and the majority of the older settlers are members.

The minimum subscribed capital is fifty £1 shares and 8,500 shares have been allotted to date. In order to meet the requirements of members, who in most cases are not able to lay down the full amount for their shares at once, payments are spread over several years, £10 being paid on application, and £10 per annum thereafter, the full payment being completed in four years. This places all members on the same footing as regards their interest in the company, but realising that some will be making greater use of the facilities offered than others, it is provided that payment for the shares can, at the

discretion of the directors, be made up by a levy of 5 per cent. on the value of the produce handled. In this way those utilising the company to a large extent may pay their full shareholding within twelve months—a proviso of some importance, as the outlay for plant and buildings increases in proportion to the quantity of fruit sold.

The work carried out for fruitgrowers by the company consists in finding markets for the produce, in grading, packing, and (where necessary) processing the fruit, and in purchasing in large quantities all farm supplies, such as manures, cases, drying trays, and machinery. In general, the method adopted of selling the fruit is to form voluntary pools of the different varieties, the direct expenses of handling being divided equally over the tonnage and a flat rate being paid out from the net profits. The different methods adopted by growers present certain difficulties at times, but growers' methods are gradually tending to become standardised, and in any case the grading of the fruit on delivery prevents injustice to the individual.

The company also acts as agent for the consignment of fruit to Sydney and other towns for sale on the growers' behalf. Representing, moreover, as it does, the majority of the producing settlers, it is fitted to express the opinions and views of the area it serves; and although this function does not legally appertain to it, it has come to be recognised as being in a position to speak on questions involving the interests of the settlers. It has also interested itself in a smaller way in the disposal of surplus dairy stock raised mainly by dairying settlers, and in the matter of finding agistment country for settlers' surplus livestock, the facilities in this case also being mainly availed of by the dairying settlers.

Other Growers also Moving.

Within the last few months yet other moves have been made. The growers of pears and apples in the Penrose district have established a co-operative packing shed, which commenced operations on 15th January. Of the activities of the Penrose and other organisations it is too early to say anything, but all of them are being watched with interest.

The success of these different primary interests in ventures of the kind is of the greatest significance, not only to fruitgrowers, but to almost all tillers of the soil.

More Evidence in Favour of Dairy Records.

The keeping of records and selective breeding have been among the primary factors in the success of Wisconsin's dairy industry, according to a recent report of the Director of the Wisconsin University Agricultural Experiment Station. The average yearly butter-fat production per cow in the United States is only 127 lb. The average production of Wisconsin's cows exceeds that figure by nearly 50 lb.; while those in the Wisconsin cow-testing associations reach an average of 265 lb.—a record equalling that of Holland, whose development has long stood as a goal in the dairy world.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Growers who have crops suitable for seed purposes are invited to communicate with the Department of Agriculture, Sydney. This should be done in ample time to allow of an inspection of the crop to be made before harvesting.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Wheat:—

Bomen	H. M. Hall and Sons, Studbrook, Cunningar.
	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Canberra...	Hughes Bros., Greenacres, Pullabooka, *via* Grenfell.
	H. M. Hall and Sons, Studbrook, Cunningar.
	S. Reilly, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	T. M. Slattery, Mirrool.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
Canberra (ungraded)	Manager, Experiment Farm, Condobolin.
Clarendon	Manager, Experiment Farm, Glen Innes
Cleveland	Manager, Experiment Farm, Bathurst
	W. Burns, Goongirwarrie, Carcoar.
	A. J. Rial, Wolseley Park.
College Purple ..	Hughston Bros., Hughstonia.
Currawa	Hughston Bros., Hughstonia.
Federation	H. M. Hall and Sons, Studbrook, Cunningar.
	T. M. Slattery, Mirrool.
	E. Idiens, Boorowa.
Florence	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Bathurst
	S. Reilly, junior, Roadside Mail, Eurimbla, *via* Cumnock.
Hard Federation .	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Cowra.
	H. M. Hall and Sons, Studbrook, Cunningar.
Improved Steinwedel	Manager, Experiment Farm, Temora.
Major ...	Manager, Experiment Farm, Temora.
	Hughston Bros., Hughstonia
Marshall's No. 3	Manager, Experiment Farm, Bathurst.
	Hobson Bros., Glenlea, Cunningar.
	S. Reilly, junior, Roadside Mail, Eurimbla, *via* Cumnock.
	A. J. Rial, Wolseley Park.
Penny	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Rymer	Mrs. J. D. Berney, Kilgara, Eurimbla, *via* Cumnock.
Thew	H. M. Hall and Sons, Studbrook, Cunningar.
Union	Manager, Experiment Farm, Temora.
Warden	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Cowra.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Cornish Bros., Scoble, Whylandra, *via* Dubbo.
	Hughston Bros., Hughstonia.
	B. J. Stocks, Linden Hills, Cunningar.

Wheat—continued.

Warren	Manager, Experiment Farm, Cowra.
Yandilla King	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Hobson Bros., Glenlea, Cunningar.
	Hughston Bros., Hughstonia.
	E. Idiens, Boorowa.
	A. J. Rial, Wolseley Park.
	Hannett Bros. and Wilson, Wellville, Cunningar.
Yandilla King (ungraded) ...	W. V. Herbert, Bongalong, Muttama.

Oats:—

Lachlan	Manager, Experiment Farm, Bathurst.
Mulga	Manager, Experiment Farm, Glen Innes.
White Tartarian	J. S. Whan, Llangothlin.

Barley:—

Kinver	Manager, Experiment Farm, Temora
Pryor	Manager, Experiment Farm, Temora

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

Boll Weevil Damage to United States Cotton.

The United States Department of Agriculture has made estimates of the boll weevil damage for each year from 1909 to 1921 inclusive. In 1909 the damage amounted to 1,368,000 bales. In 1910 the damage was slightly less than in 1909, and in 1911 the damage was the least for any of these years, amounting to 338,000 bales. From 1912 to 1919 inclusive, the boll weevil damage fluctuated between 714,000 bales and 2,994,000 bales, this latter figure having been reached for the 1916 crop.

The economic burden of the boll weevil to the cotton producers can be made more understandable perhaps by comparative figures. For example, the picked crop of cotton lint was 7,954,000 bales in 1921, and the weevil prevented the production of 6,267,000 bales. Hence, the damage to the crop was equal to 79 per cent. of the harvested crop. Had the weevil been innocuous, the cotton acreage of 1921, small as it was, would have produced 14.231,000 bales of lint cotton.

To express the matter in another way, had it not been for the boll weevil, the actual crop in 1921 could have been obtained from 66 per cent. of the acreage cultivated. In other words, out of every 100 acres cultivated, the producer received as his share the cotton from 42 acres, since causes of damage other than boll weevil prevented the production of 24 acres, and the boll weevil itself fed on the cotton raised on the remaining 34 acres.

The cotton production that the weevil has prevented has greatly increased during the last two years. Expressed as a fraction of the full potential production of cotton, the damage by the boll weevil in 1921 was about 34 per cent., or, in other words, one-third of the potential production was prevented by this voracious pest. One-fifth, or 20·5 per cent., represented the weevil damage in 1920. Before that year the damage ranged from 14·3 per cent. of potential production in 1916, to 1·5 per cent in 1911.—*International Review of the Science and Practice of Agriculture.*

Poultry Notes.

June.

JAMES HADLINGTON, Poultry Expert.

The beginning of this month should see the first eggs of the season in the incubators. Most likely only a small number of eggs will be available, but what are forthcoming will be valuable, no matter what breed. One of the debatable matters among commercial poultry-farmers is the advisability or otherwise of setting light breed eggs so early. The argument put forward by those who deprecate the course is that the early-hatched Leghorn, for instance, will break up into a partial moult just when eggs are at their maximum price. This is the case, of course; nevertheless these early-hatched pullets are a most valuable asset on any farm, and on one or two counts.

First, such early pullets, if they have been properly handled, will generally come on to lay during January, and continue to lay more or less (much in proportion to the skill and attention bestowed upon them) until April, when they generally break into moult and take a spell until June. In the meantime eggs have been laid while prices are on the rise, in recent years usually varying between 1s. 9d. and 2s. 6d. per dozen. These pullets, therefore, cannot be said to have laid in the cheap season and to have ceased to do so when high prices are obtainable. The pinnacle of prices is usually reached early in May.

However, this is not put forward as the principal advantage to be derived from such early hatching of light breeds. If it was a matter of eggs only and of knowing all the incidence in connection with the average result obtained by the average farmer, one might not be so strong in advising so early hatching of light breeds. There is, however, a much greater advantage to be derived from them, and this is that the pullets that thus cease to lay for a few weeks, moult, and then come on again, are very valuable as breeders. They put the poultry-farmer in a position to breed from pullets that are matured. The alternative is to hatch from second or third-year hens, and these do not, as a rule, lay many eggs before August. It is here that the reason can be found why so many breeders, who deprecate the use of pullets as breeders, fail to secure early-hatched stock. Their idea is that immature pullets should not be used as breeding stock, whereas June and July hatched birds, if well grown, are quite fit to use as breeders in the following June. From such birds a succession of early hatchings can be insured, which cannot be done when aged hens are solely relied upon. In most cases the expectation of aged hens coming on to lay before August is a case of hope deferred followed by disappointments, and the bulk of the

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season's hatchings are late. It is to early pullets that one must look for a succession of early chickens. Generally the scarcity of eggs so early in the season will prevent too many being hatched in June and July.

Maintain Constitution.

The maintenance of the physique and constitutional vigour of the flocks is dependent upon early hatching to a much larger extent than is generally conceded. It is a matter of common knowledge that much better development, other things being equal, is secured in the early—than in late—hatched stock. This, in itself, should convince the most sceptical of the necessity of hatching early, a proportion of the annual output of chickens. It is an observed fact that the farmer who habitually hatches late, or who, in order to gain a few pounds in the early months, sells day-old chickens which he should have kept for himself, is doomed to fail within a few years, sometimes inside of two.

Day-old Chickens.

It is not too much to say that hundreds of poultry-farmers have failed in recent years through grasping out for the day-old chicken trade and leaving themselves stranded with little or no early-hatched stock which can be used as breeders. This is usually the result of an over-optimistic anticipation of hatching results. What occurs is that too many orders are booked for early chickens, and rather than disappoint customers the more conscientious farmer takes risks which often spell ruin to himself. In these cases the first law of nature should have been kept in view, namely, self-preservation. What does it profit a poultry-farmer if he gain a temporary benefit and ruin his own prospects? The day-old chicken trade has of course come to stay, but taken by and large it is not an unmixed blessing to the poultry industry.

Incubation.

In these notes for May, 1920, and again in June, 1922, advice was given on the operation of an incubator, and on lines universally accepted as sound practice. They embodied not only my own experience but that of hundreds of successful farmers, yet last season I came in contact with many novices who, not content to follow the beaten track of experience, must needs experiment on their own account. Among these experiments were some so foolish as to be amusing, were it not for the tragic results that accrued from them. When it is considered that the loss of a hatching season means reducing by half the profitable stock being carried on a farm, it should be obvious that to experiment during the main hatching season is to court disaster. A good deal of experimentation arises, of course, from partial failure in hatching, but instead of looking in the right direction for the cause of such failure, experiments in incubation are tried which lead to nowhere. The point is, if an incubator is being operated in accordance with the instructions contained in the ten points detailed below, then it is not faulty incubation but some other circumstance that is the cause of the trouble

Dead in the Shell.

Dead chickens at hatching time are usually the cause of the operator experimenting with his machine. This trouble may, of course, arise from faulty incubation, but if the advice referred to has been followed faithfully the fault should be looked for in other directions. The farmer might commence by looking into the following points?— (a) Is the breeding stock all right, or is it lacking in physique and vigour? (b) Is the male bird in good condition? What is his weight? What should it be? (c) Are the eggs under seven days old? (d) Is the feeding right, or are the birds being underfed, or surfeited with food in such a manner as to take the edge off their keenness for food? Is the diet of the birds too rich in nitrogenous matter, or is it in anyway over-stimulating?

The farmer should treat his breeding stock in such a way as to ensure moderate production. If the breeding stock is so stimulated as to force the birds to yield the last possible egg, then the chances are against good hatchable eggs being obtained. In such cases incubation is invariably blamed for the trouble, whereas the cause lies in another direction.

In this connection, it might be stated that too narrow a ration, in other words, too big a percentage of protein as compared with carbohydrates and fat, whether the proteids are of animal or of vegetable origin, is invariably destructive of good hatching results. Many poultry-farmers may be found each season increasing the protein content by the use of extra meat meal, bone meal, linseed meal, pea meal, or such highly nitrogenous food, with the hope of getting improved hatchings. Such a course usually leads to poor results, and confusion of ideas as to the cause almost invariably follows.

For the benefit of new readers, the ten points on the operation of an incubator are again published.

How to Operate an Incubator.

1. *A Sanitary Incubator.*—See that the incubator is in good sanitary condition.

2. *Thermometers.*—Test all thermometers before starting the season, and again later on. It does not follow that because a thermometer is true one season it will remain so. The instruments are liable to get out of order, hence the necessity for frequent testings. Where a number of thermometers are in use they may be put into a vessel of warm water, at, say, about 106 degrees Fah., and allowed to remain in it until the temperature recedes a few degrees; if there is any discrepancy in the temperatures registered, it will of course be necessary to find out which are right and which are wrong. If among the number there are only one or two showing variations from the rest, it can generally be concluded that the minority are wrong. However, the safest plan is to procure a tested thermometer with which to compare the others.

3. *Starting the Hatch.*—When starting an incubator the temperature should be got up to, and maintained at, 103 degrees for at least twelve hours

before the eggs are put in. When the eggs are put in the temperature will fall, and it is best to allow about another twelve hours for the heat to rise to 102, at which point the incubator should be regulated to run steady. It is a mistake to raise the temperature too fast. If a lamp machine is in use, the lamp should be kept quite clean and the wick free from incrustation.

4. *Eggs.*—Fresh eggs under a week old, and from physically strong stock, are necessary to ensure successful hatching.

5. *Operating.*—Before starting the incubator see that the regulating device is in perfect working order, and that the bulb of the thermometer stands just clear of the eggs, or *not more than half an inch* above them.

6. *Temperature.*—Bring the temperature in the incubator up to 102 degrees; this should be raised another degree as the hatch progresses. Between 102 and 103 degrees is the best temperature to run at, leaning to the high side towards the end of the hatch. When the first egg is seen to be chipped, which may occur on the nineteenth day if the eggs be fresh, let the temperature run up to 104 to 105 degrees until the hatch is finished. For these temperatures the bulb of the thermometer should stand just clear of the eggs; half an inch above is a good position.

7. *Turning.*—Commence to turn the eggs when they have been in the machine thirty-six hours, and turn them at least twice daily up to the ninth day; once per day afterwards is all that is absolutely necessary. Each time the eggs are turned move the relative position from middle to side and *vice versa*. Stop turning when the first egg is seen to be chipped.

8. *Testing.*—The eggs should be tested about the sixth day; at that time even a novice can generally pick out the infertile eggs with a good tester.

9. *Cooling.*—Commence cooling the eggs for a few minutes once per day after the sixth day, and gradually increase the time of cooling as the hatch progresses—first to ten minutes, then to fifteen, and up to twenty or even thirty minutes, according to the temperature of the room. But eggs should not be cooled for thirty minutes as a regular thing or too often. Cooling should be stopped when the first egg is chipped.

10. *Ventilation.*—Little if any ventilation is required up to the time of commencing to cool, about the sixth day. A gradual amount of ventilation may then be allowed up to the time the first egg is chipped, when the ventilators are better nearly closed. Most incubators are over-ventilated. Experience proves that applied moisture is unnecessary, and in many cases harmful, and most large operators dispense with it altogether.

Mules for Sale.

The Department of Agriculture has for sale a number of mules which have been bred at Yanco Experiment Farm. The majority of the animals are at present located at North Bangaroo Stud Farm. These mules are nearly all from two to four years old, though there are a few younger and others older. Applications should be addressed to the Under Secretary and Director, Department of Agriculture, Sydney.

The "Yema" Budded Vine.

A Comparison with Bench-grafted and Spring Field-grafted Stocks.

H. L. MANUEL, Viticultural Expert.

With preparations for this season's vine-planting approaching, it seems advisable to bring before those intending planting a few of the advantages of the resistant vine, budded by the method known as "Yema." In previous issues of the *Agricultural Gazette* articles have appeared describing

The Results of "Yema" Budding.

Ungrafted resistant rootlings were planted in September, 1921, and Yema budded in the field in February, 1922. The photograph shows the growth made between the spring of 1922, and February, 1923, the vines having been topped three times during the season to facilitate horse cultivation.

the operation; and a free leaflet on the subject is procurable from the Department of Agriculture on application. It is sufficient at present to dwell upon some of the advantages possessed by the Yema-budded vine over ordinary bench and spring field grafted stocks. At the same time I am anxious to try and break down any prejudice that may exist in the minds of those who are not familiar with it in practice.

If we take the case of ungrafted rootlings being planted in the spring, and receiving normal treatment during the summer months, they should become fairly well established by the latter part of summer, enabling them to be Yema-budded during the period for such work. The period extends from mid-January until March, according to season and ripeness of scion wood to start. After the budding operations are complete the process of callousing takes place gradually, and the bud remains dormant until the spring, when it bursts into leaf, having the advantage of the full growing season before it. In the case of the field-graft, the position is somewhat different, the operation being done in the spring, which, by the time the callousing, &c., has

Bench-grafted Resistant Rootlings.

These vines were planted at the same time as those in the previous illustration.

progressed enough, does not allow of the same growing period as the Yema does. Again, with Yema budding, one has two chances, as it were; if a vine fails with the bud, it can be grafted later in the spring.

A Yema-budded vine will usually make sufficient growth to enable the formation of a strong stem the first pruning. With the spring field-graft and the bench-graft, this is not always possible, as the first season's pruning very often means cutting back to a spur. One could say that with the bench-graft this procedure is a general rule. The union made with the Yema method is far superior to that of both the spring field- and bench-grafts.

Vines that are Yema-budded require a little periodical attention throughout the first growing season in the matter of disbudding of water shoots from the stock. This gives the young scion shoot the full benefit of supply of sap.

An experienced man budding under good conditions will look for a 95 per cent. take, and such a man has been known to bud and tie 400 vines per day. A team of four men budding, two boys tying, and two boys opening out and mounding up, put through 27,404 vines in thirteen days this season at Chipping Norton Soldier's Settlement. A beginner will only do for a start 50 to 100 vines per day, and should not attempt pace at the start. He should aim at doing the work carefully and well; pace will come gradually.

The Storage of Pumpkins.

Only mature pumpkins should be stored. The intervention of frosts always means a certain percentage of unripe specimens, and care should be taken to use these as soon as possible. Those from early sown crops usually lend themselves best to storage. If it is found that the rind is difficult to pierce with the thumb-nail, no difficulty should be experienced in keeping pumpkins during the winter, providing they are pulled with the stalk attached and handled without bruising.

Pumpkins are best stored in a dry, airy shed, preferably on slatted shelves; they should be examined from time to time, any showing signs of decay being removed. In the case of large quantities, where indoor storage is impracticable, storage in the open may be employed. The best plan is to stack them on poles, so that they may be kept as dry as possible. They should be arranged in a single layer and laid on their sides; when laid on the flat the depression in the centre is liable to hold water and cause decay. They should not be allowed to touch one another, nor should straw or other such moisture-holding material be placed over or beneath them. On the roof of an iron shed is a favourite storing place for pumpkins on many coastal farms.—A. J. Pinn, Special Agricultural Instructor.

Agriculture—the Birthplace of Credit.

The cultivation of the ground including the harvesting of crops and the rearing and management of livestock, is not only the oldest, but the most widely dispersed occupation of civilised man. The interval between seed time and harvest, between the rearing and killing of beasts, probably necessitated in the earliest times the use of some system of credit. Indeed, it may be assumed that agriculture gave birth to the conception of credit. It is therefore natural that credit should have come to be regarded by the farmer as an essential element in the productive process. Although there has been a tendency in most countries to isolate "agricultural credit" and to treat it as a peculiar credit problem demanding special consideration, fundamentally credit plays the same part in agriculture as in any other industry.—Report of the Committee appointed by the Government of Great Britain to inquire into the question of Agricultural Credit.

Orchard Experiments.

Sprays for Peach-curl on Trial at Yanco.

W. W. COOKE, Orchardist, Yanco Experiment Farm.

Experiments for the control of peach-leaf curl have been carried out for a number of years at Yanco Experiment Farm. The following table shows the number and the nature of the experiments carried out for the season 1922-23. The variety used was Elberta.

Freshly made lime-sulphur was used for experiments numbers 4, 5, and 11; that used for experiments numbers 1, 8, and 10 had been made two months previously and stored in a wooden cask. When used at full winter strength (column *a*, page 31, Farmers' Bulletin, "Spraying,"), both strengths of lime-sulphur gave absolute control. When further diluted (1 in 12, as in column *b*), slight leaf-curl occurred, although the control was good. Lime-sulphur at winter strength, applied at the later date was quite as effective as when used on the earlier date.

It would appear from this year's experiments that the time of application of lime-sulphur for the control of leaf-curl may be extended from 12th July to 10th August, thus giving a month in which to complete the spraying, and that Bordeaux mixture, 6-4-40, gives as good results as 6-4-22.

Results of Peach-leaf Curl Experiments.

Plot	No. of Trees.	Date Sprayed.	Spray Used.	Result.
1	12	12th July...	Departmental lime-sulphur diluted as in *a*, page 31 "Spraying."	Absolutely clean.
2	3	13th July .	Bordeaux mixture 6-4-22	Absolutely clean.
3	3	13th July...	Bordeaux mixture 6-4-40	Absolutely clean.
4	4	1st August .	Departmental lime sulphur diluted as in *a*, page 31, "Spraying."	Absolutely clean.
5	4	10th August	Departmental lime-sulphur diluted as in *b*, page 31, "Spraying."	Very slight leaf-curl.
6	4	14th July ..	Formaldehyde, 1½ oz per gallon of water.	Slight leaf-curl.
7	2	14th July	Formaldehyde, 1½ oz and dusted with sulphur.	Slight leaf-curl.
8	12	12th July...	Lime sulphur, (27 degrees Baume), 1 in 12.	Very slight leaf-curl.
9	6	Check ...	Not sprayed	A considerable amount of leaf-curl.
10	10	13th July...	Departmental lime sulphur diluted as in *b*, page 31, "Spraying."	Very slight leaf-curl.
11	3	10th August	Departmental lime-sulphur diluted as in *a*, page 31, "Spraying."	Absolutely clean.

Orchard Notes.

June.

W. J. ALLEN and W. LE GAY BRERETON.

Planting.

As a rule, June is a good time for planting all deciduous fruit-trees in this State, but in districts that have experienced a dry autumn and that have had no early winter soaking rains, the ground will be too dry; and where irrigation cannot be provided, it will be better to hold the trees in nursery rows, where they can be conveniently looked after, and to defer planting till the ground is in moister condition. Early planting is preferable where soil conditions will allow, because the tree starts root growth long before any move is noticeable in the top, and it is advantageous that this first root growth be made in the permanent position. If soaking rains do not occur before the spring, it may be imperative to plant while the soil is still dry, and in such cases it will be necessary to follow the planting closely with three or four buckets of water. When this method has to be adopted it is best when planting not to fill soil into the holes to the top, but to leave a basin to take the water. After the water has soaked in, the holes should be filled up with dry soil to form a mulch before the wet soil below has become baked. Each day's planting should be watered not later than the following day.

The distance trees should be planted apart is largely governed by the rainfall. In our inland districts, where the rainfall is limited, not less than 24 to 25 feet should be given. In many of our coastal districts, where the rainfall is heavier and more regular, the distance can be reduced to 20 feet. Even where the rainfall is ample to plant at the lesser distance, it is necessary to give more room on rich soils, where the trees grow to a large size. This applies to the alluvial flats of the coast, some of our tableland districts, and also to the Murrumbidgee Irrigation Areas.

When planting provision should always be made for cross pollination. This can be most conveniently done by planting each variety in pairs of rows and placing those that blossom at the same time alongside one another. For instance, if Williams and Beurre Bosc pears are to be planted, plant two rows of one and then two rows of the other. If a greater number of one variety is to be planted than of the other, then plant two rows of the greater number and one row of the lesser. This latter arrangement is not so convenient for spraying and picking.

Pruning.

Though in big orchards of stone fruits it is wise to get a start on the pruning during May, it is generally not till June that much can be done with apples and pears, on account of the foliage hanging on the trees longer. In many localities owing to heavy crops and dry conditions, especially in the

latter part of summer, the majority of the fruit spurs of both apples and pears are weak. This will call for more attentive pruning than where the opposite is the case, as care will have to be taken to leave as many good plump spurs as possible to carry the ensuing crop. A close look-out should be kept during pruning for any pest or disease attacking the trees, and such trees, as well as any weak trees, should be marked for special treatment.

Pests.

The bandages should still be left on apple and pear trees, for as the cold weather increases, and especially after rain, codlin grubs will leave less protected places to shelter in the bandages. These can then be destroyed by dipping the bandages in boiling water sometime before the spring.

If not already done, apple-trees that have become infected with woolly aphis during the busy harvesting season should be thoroughly cleaned by spraying with tobacco wash.

San José scale generally makes its first appearance in an orchard on a few trees only, and it is a good plan to give such trees special treatment as soon as the leaves are off or nearly so. First prune the trees with the burner close at hand so that the prunings can be immediately destroyed. When pruning these trees be careful not to rub up against any others, and when the infested trees are done, the clothes should not be used again in the orchard until they have been washed; the hat should be well brushed, and all tools used on the job should be thoroughly cleaned with kerosene.

After pruning, every part of the trees should receive a soaking spray of either lime-sulphur or spray oil. If lime-sulphur be used mix it somewhat stronger than the normal winter strength. As spraying in the manner described uses a lot of spray on a big tree, there is a tendency to form a pool round the butt and care must be exercised if an oil spray be used. The best method is first to spray the butt; then throw in earth round the butt and give the tree the drenching spray with oil; when completed, throw the soil out again into the centre of the row.

As it is likely that other trees in the same block are slightly infected, though not sufficiently for detection, the whole block, including the trees which have received special treatment, should later receive a normal spraying.

Other Seasonable Work.

Ploughing should be started early enough to have it completed by the middle of July.

The orange crop is mostly light this year, and there will be no need to lighten the trees early. Harvesting will thus be chiefly governed by the prices and prospects of the market.

"I BEG to acknowledge, with thanks, receipt of a parcel of your Department's publications. I think you will be glad to know that they will be of great service to us, and that one of them was of immediate use, and responsible for saving the sight—perhaps the life—of a milking cow suffering from an eye disease."—AN EMERALD HILL CORRESPONDENT.

June Work in the Apiary.

W. A. GOODACRE, Senior Apiary Instructor.

PROBABLY the best answer to the question, "What should be done amongst the bees during this month?" is "leave them alone." There are only one or two localities in the very warm districts where a winter flow of honey obtains and work can be carried out, and in these parts, probably in only one season out of four.

If a hive containing bees is opened up at this period of the year in a cool climate, the bees will be found to be clustered thickly together, and occupying probably less than half as many combs as the same number would cover in the working season during warm weather. This clustering together creates warmth and allows the bees to keep up the required temperature. The centre of the cluster is naturally the warmest part, but the bees are not selfish in the matter of occupying the cosiest position, as is shown by the practically continuous slow movement of the bees from the inside to the outside of the cluster, and *vice versa*. This exchange of position gives all the bees in the hive an equal chance to conserve their vitality. One can imagine the disorganisation and the trouble the bees would have to raise the temperature again, if the bee-farmer were to disturb them at this period.

Bees do not hibernate during winter as is often supposed, but they can be described as going into a quiescent state. If a hive is opened up while the bees are in this condition they show very little activity, but they are capable, however, of raising their abdomens and producing the sting. This barrier of stings offers a measure of protection against intruders.

The past season was a poor one generally, and the supplies being placed on the market are small and prices obtained for honey, good. Usually, at this period of the season, bee-farmers are much concerned about marketing conditions and interest is taken in the endeavours to improve matters by co-operative methods. Now, after a poor season, practically no difficulties in marketing are being experienced, yet, if we wish to succeed in our efforts to make provision for future years, the interest in co-operative marketing should be maintained. Probably next season will be a normal one again, and any ground lost through apathy at this period, will be felt then.

In a good number of localities in the western district, the prospects for the coming season are promising. The Yellow Box (*Eucalyptus melliodora*) along with a fair variety of other flora is heavily budded. With any show of normal weather conditions and the Yellow Box trees flowering well, good crops of honey will be obtained. Good winter rains in the inland districts will assist in the development of the buds now showing on the trees.

In many parts, the colonies will come through the winter in a more or less weak condition, but apiarists should be well repaid for any care exercised in wintering and spring work.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
Peak Hill P. and A. Society	T. Jackson	July 24, 25
Condobolin P. and A. Society	C. H. Leiferman	,, 31, Aug. 1
Bogan Gate P. and A. Society	J. Egan	Aug. 8
Parkes P. A. and H. Association	L. S. Seaborn	,, 14, 15
Forbes P. A. and H. Association	W. T. Gilchrist	,, 20, 21, 22
Corowa P. A. and H. Society	J. D. Fraser	,, 21, 22
Grenfell P. A. and H. Association	G. Cousins	,, 28, 29
Murrumbidgee P. and A. Association (Wagga)	F. H Croaker	,, 28, 29, 30
Culcairn P. A. H. and I. Society	L. H. M. Newton	Sept 4, 5
Manildra P. and A. Society	I. C. Longley	,, 5
Barmedman A. and H. Society	A. J. Meagher	,, 5
Young P. and A. Association	T. A. Tester	,, 4, 5, 6
Junee P. A. and I. Association	T. C. Humphrys	6, 7
Cowra P. A. and H. Association	E. P. Todhunter	11, 12
Cootamundra A. P. H. and I. Association	W. W. Brunton	11, 12
Gunnedah P. A. and H. Association	M. C. Tweedie	11, 12, 13
Holbrook P. A. and H. Society	J. S. Stewart	18, 19
Ganmain A. and P. Association	T. S. Henderson	18, 19
Canowindra P. A. and H. Association	J. T. Rule	18, 19
Temora P. A. H. and I. Association	A. D. Ness	18, 19, 20
Boorowa P. A. and H. Association	W. Burns	20, 21
Northern A. Association (Singleton)	J. T. McMahon	20, 21, 22
Murrumburrah P., A., and I. Association	W. Worner	25, 26
West Wyalong P. A. H. and I. Association	T. A. Smith	25, 26, 27
Hay P. and A. Association	C. L. Lincolne	26, 27
Koorawatha A. Society	J. A. Larson	Oct. 2
Ardlethan A. Society	R. Neill	,, 3
Narandera P. and A. Association	W. H. Canton	,, 3, 4
Ariah Park A. Society	J. F. McInnes	,, 10
Lismore A. and I. Society	H Pritchard	Nov. 20, 21, 22

1924.

Society.	Secretary.	Date.
Albion Park A. and H. Association	H. R Hobart	Jan. 11, 12
Guyra P. A. and H. Association	P. N. Stevenson	Feb. 19, 20, 21
Moruya A. and P. Society	H. P. Jeffery	,, 20, 21
Newcastle A., H., and I. Association	E. J. Dann	Feb. 26 to Mar. 1
Manning River A. and H. Association (Taree)	R. Plummer	Mar. 4, 5, 6
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	,, 11, 12, 13
Campbelltown A. Society	J. T. Deane	,, 28, 29
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 9, 10, 11

BOTANY IN RELATION TO CEREAL-GROWING.

THE practical farmer can grow successful crops without a knowledge of botany as relating to cereals. At the same time, the farmer will find it an advantage to know in what way the more common types and varieties of cereals are related to one another. Probably the chief advantage in possessing this elementary knowledge is that it will assist him in a wise choice of varieties, and in understanding how to combat diseases.—A.I.F. Education Service Land Book No. 4.

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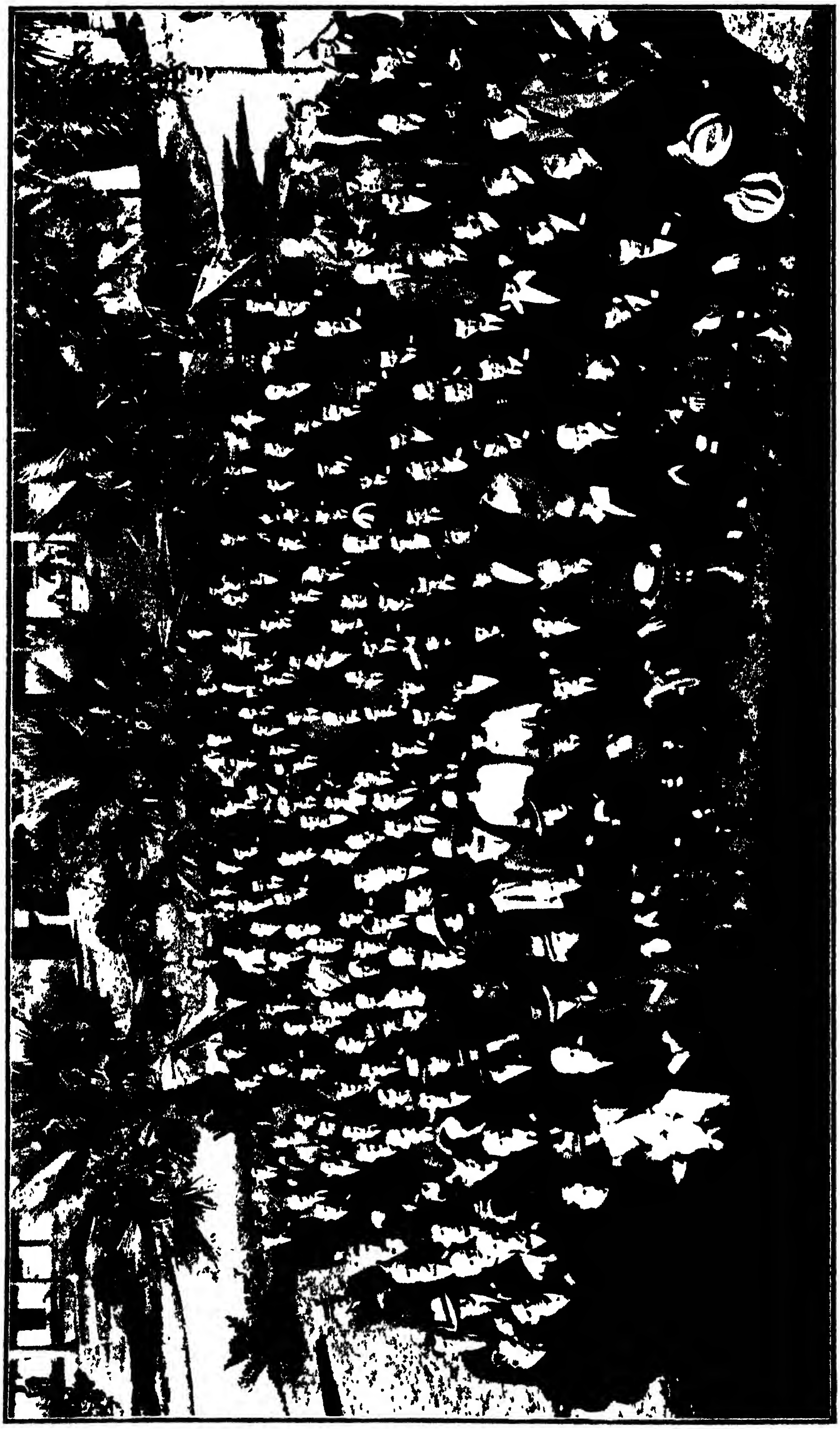

The First State Conference of the Agricultural Bureau of New South Wales

Agricultural Gazette of New South Wales.

Farm Competition on the Murrumbidgee Irrigation Areas.

E. B. FURBY, Agricultural Instructor.

LATE last year a competition was inaugurated by the Water Conservation and Irrigation Commission for (*a*) the best kept dairy farm, and (*b*) the best kept horticultural farm, first and second prizes being allotted to the value of £25 and £10 respectively in both sections. The competition was confined to returned soldier settlers on the Leeton and Mirrool portions of the area. On the Mirrool area fifteen horticultural farms (the judging of which was in the hands of the local fruit inspectors) and seven dairy farms were entered, two of the latter being afterwards withdrawn from the competition.

For the purpose of judging the dairy farms a scale of points was drawn up, giving special attention to the principal features of dairy-farming under local conditions, these being (*a*) care and condition of live stock, (*b*) cultural methods adopted, and (*c*) provision of fodder. The points awarded to the individual farms are set out in the following table:—

DETAILS of the Awards.

	Maximum Points.	S. H. Kelly, Farm 529.	H. Markey, Farm 968*.	A. B. C. Wood, Farm 417.	P. W. Barton, Farm 538.	G. McKissick, Farm 402.	G. Dan, Farm 1463.
1. Fences and Gates—		Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
(*a*) Boundary (maintenance) ..	30	28	29	25	23	23	23
(*b*) Subdivision (maintenance and economy and efficiency of lay-out) ...	50	45	45	40	40	40	40
2. Buildings—							
House, sheds, yards (care and maintenance) ..	30	28	28	20	20	23	23
Settler's own buildings	20	15	15	12	12	10	10
3. Plant—							
Implements, harness, tools, vehicles, &c. (care and maintenance)	50	42	45	35	35	30	35
4. Live Stock—Horses, cattle, pigs, poultry—							
(*a*) Care and condition	100	80	90	80	75	70	75
(*b*) Method of improvement ..	50	40	40	40	40	40	40
5. Cultural Methods—							
General farming and cultivation	150	135	125	125	120	115	115
6. Fodder Provision—							
(*a*) Growing crops ..	75	65	60	60	65	50	60
(*b*) Conservation ..	50	20	20	35	20	25	10
(*c*) Condition of fodder on land ..	50	40	40	40	40	35	.
7. General Merits							
(*a*) Care of ditches and culverts; weed eradication	50	40	40	35	30	25	30
(*b*) General development of farm	50	47	45	45	35	35	40
(*c*) Initiative of settler ..	50	45	40	40	35	45	35
Total points ..	805	670	662	637	596	571	536

* Leeton area.

Throughout the competition a very keen desire was evinced on the part of the settlers to display their farms to the best advantage. This was made the more difficult by the fact that at the period of the year when the farms were

judged (February) a heavy demand was made upon growing crops for grazing purposes. Earlier in the summer would have found every farm with good standing crops, and it was a matter of disappointment to some that the judging did not take place then. The period of judging, however, constituted something of a test of the system of farming, bringing out on top those settlers who consistently provided for their cattle at all periods. The entries generally reflected a genuine effort on the part of competitors to counteract such drawbacks as are associated with dairying on the areas, by the establishment of their farms on good sound lines, and the reduction of the cost of working to a minimum.

A few comments on the various headings under which the points were awarded may not be out of place.

Fences and Gates.

Generally speaking, the condition of the fencing on all farms was very good, though more attention might have been given in some cases to the tightening up of the wires and the provision of barbed-wire on the boundary fences. The provision of suitable and effective gates is a matter requiring urgent attention—the inconvenient and dangerous hanging panels of barbed-wire do not tend towards efficiency. It might be stated here that the home-made wooden gates on the farm that won the second prize were cheap in their construction and constituted very effective barriers to the stock.

The subdivision of the farms has apparently been well studied by their owners from the point of view of convenience of working, both for grazing and for cultivation. Small paddocks of 12 to 15 acres were the usual size, and these proved to be large enough for economical working and to produce crops which could be grazed off rapidly. The farms of Mr. Wood and Mr. Kelly were outstanding in this regard.

Houses, Sheds, Yards, &c.

Improvements under this heading consisted of those financed by the Irrigation Commission and those erected by the settlers themselves. Those buildings erected by the Commission were houses, dairies, bails, and cow-yards, and were practically all of one design and construction, very substantial, and well kept. Settlers' own improvements, consisting of implement sheds, pig-sties, horse-yard, &c., were more or less of a temporary nature and not too well constructed. In justification of the structures erected, it may be pointed out that good building material cannot be obtained so easily locally as on the coast and in other districts, and the temporary buildings will no doubt be replaced by more permanent and attractive structures as the farms become more productive and the settlers' liabilities to the Crown are reduced. On the two winning farms there have been erected first-class pig-sties, which show a good deal of initiative on the part of the settlers and a thorough knowledge of the requirements of the pig. These structures will serve their purpose for many years without additions. On Mr. Wood's farm substantial sties have been built, but yards are required to complete the scheme.

It cannot be said that no attempt is made to make farm life attractive on the area. Each farm visited had its acre of fruit trees and small patch of flowers. The growing of vegetables for home consumption appears, on the other hand, to be somewhat neglected, but as this is a matter which takes up a considerable amount of time it is no wonder that such gardens—started often in all earnestness—so often show signs of neglect in a short time. The farm of Mr. Kelly had been made very attractive by its nicely-kept orchard block and netted-in vegetable garden, while the inclusion of a few hardy perennial flowering plants and creepers showed that this settler had also an eye to beauty.

Plant.

As stated above, the difficulty of providing cheap and suitable housing accommodation for implements explains why one finds so much of the settlers' machinery and plant exposed to the elements, but shelter for perishable machinery, such as binders, mowers, drills, and wagons, is a very important necessity, and it would have reflected more credit upon the settlers concerned if better, though temporary, provision had been made for this covering. It was gratifying to find on Mr. Markey's farm that all machinery was under cover and well protected from the weather by a shed erected at his own expense; such a shed must always be considered a permanent improvement.

The harness in most cases showed signs of utter neglect, despite the fact that occasional treatment with suitable oil costs little and saves pounds in lengthening its life.

Special attention appears to have been given to the milking plant where one is used, and it is to the credit of these settlers that dirty milking plant is not the cause of the cream being graded as of second quality, but rather factors that enter after it leaves their farms.

Live-stock.

For the most part the dairy stock have been supplied to the settlers on terms by the Commission, and all the herds were found to be in very fair condition. Every endeavour has apparently been made to keep the stock looking well, besides giving large quantities of milk. Pure-bred and grade cattle made up the herds, and in every case pure-bred bulls were to be found. By careful selection, and by culling out unworthy animals, these settlers will in time work up herds of milkers which will be a credit to the area, and to the industry. At present no assistance is given settlers in the matter of herd-testing, but as each settler was keenly alive to the necessity of having each milker regularly tested, no doubt before long arrangements will be made to have this important function regularly performed. The settlers realise that it is useless to cull out animals without definite proof of their failure.

Some very fair pigs were to be found on the competing farms, though the standard of quality in breeding sows might be considerably improved, whilst better quality and better bred boars are certainly required. On practically every farm visited there was evidence of over-stocking without suitable arrangements being made to supply their food requirements. A policy that

might well be adopted by these farmers is to have a surplus of food rather than a surplus of pigs, aiming at a few well-grown and matured animals instead of a lot of poorly bred and hungry animals, necessarily commanding a low market price. On the farm of Mr. H. Markey was found a pen of seven porkers which would command the admiration of the keenest buyer, both on account of the quality of the pigs themselves and of the sound feeding and stocking methods adopted.

The horses worked by the settlers were all in good working condition, and the fact that none were found out of commission showed that they had been carefully handled and well attended to.

The keeping of poultry is a side-line which has attracted little notice on these farms, sufficient birds only being kept to supply settlers' own requirements. In view of the fact that there is a fairly good local demand for eggs, this branch of farming should certainly be taken up more seriously.

Cultural Methods

It might be set down as an axiom that the farmer who ploughs, cultivates, and "manages" his soil efficiently, will surely be prosperous. The gospel of "better cultivation" is by no means a new one, but where that gospel has been set forth in other farming districts, and taken up enthusiastically by the farmers, there is sufficient evidence to show that those farmers have benefited substantially. That the standard of cultivation and irrigation obtaining in the area can be enormously improved was manifested in the competing farms. No doubt the best was being done under adverse circumstances as to labour and funds, but there can be no excuse for bad ploughing, slipshod irrigation methods, and low-class cultivation.

The soils of the area are of many types, good and bad, both requiring very careful management, and every settler would be well advised to plough deeper, cultivate more often and more efficiently, and fallow as often as possible, even for short periods if the area of the farm does not allow of paddocks standing idle for several months at a stretch. The sowing of rotation crops, or preparation crops, such as lucerne and Bokhara clover, is also a practice which should receive more attention.

Grazing off crops during irrigation is a practice which must be condemned from the start, for it is one of the first stages of failure, besides doing irreparable damage to the soil. Fortunately it was found that this was being avoided as far as possible.

On the winning farm a very sound system of ploughing thoroughly, cultivating well, and irrigating judiciously, has proved to be efficacious, as was evidenced in the good crops obtained.

Provision of Fodder.

Success in dairy-farming on the irrigation area is so closely related to the growing of suitable crops for grazing purposes that recognition of the fact by the competitor was made an important point in judging. In coastal dairying the natural pastures lend considerable assistance to the dairy-farmer.

On the irrigation areas, on the other hand, natural pasture must be totally disregarded, for it can only be regarded as a failure as a source of feed unless there is a practically unlimited area of it.

The provision of fodder resolves itself into the growing of crops all the year round. With the wide range of crops which can be grown here, both in winter and the summer, this is not altogether a difficult undertaking, though requiring very careful and painstaking manipulation. The crops may be either perennial or annual. The former, comprising lucerne, paspalum, and Rhodes grass, found favour with every competitor. Paspalum and Rhodes grass, though not showing any great promise, were sufficiently well advanced to be used as night or rest paddocks, while others were being irrigated. One farm was found to be almost completely sown down with lucerne. This, however, is not recommended, for while it is easily handled, it does not provide the properly balanced food so essential to high milk yields.

Of the annual crops, too much regard seemed to have been given to Japanese millet and Sudan grass for summer feeding. Though serving a purpose in giving green feed quickly, they cannot be compared with maize and sorghum for bulk. Even the value of sorghum as an early winter feed was almost entirely overlooked by each competitor. Winter grazing crops were not, of course, in evidence. Both the winning farm, and that of Mr. Barton, were fairly well supplied with growing summer crops.

An attempt had been made by all competitors to conserve a certain amount of hay for winter use. This is certainly recommended, especially where lucerne had been stored also, as in the case of Mr. Wood, whose practice it was to cut the lucerne instead of grazing it. For winter feeding it is essential that some feed be stored, for very little growth of crops is made during the middle of winter; moreover, the ground is invariably wet, and much crop is spoilt by turning cattle on it.

So far no attempt has been made to conserve fodder in silos, and it would be fairly safe to say that until such times as dairy farmers here adopt this system, and hand-feed at least during the winter months, the local dairy industry will remain a more or less precarious undertaking.

Of the growing crops found on the farms, those of Mr. Kelly and Mr. Barton could be classed as fair, both having average maize crops suitable for feeding, with smaller areas of sorghum coming on. Mr. Wood had a very fine stand of lucerne which showed signs of being well looked after. The stored hay in all cases was found to be of good quality, well made, and preserved.

General Merits.

Efficient watering largely depends upon the efficiency of the supply system. Badly made and neglected ditches, besides being a source of continued trouble, will not deliver the required quantities of water, the crops being only partially irrigated as a result. This condition of affairs, it is pleasant to remark, was not tolerated by any of the competitors, and they must be

commended for the manner in which they have maintained their water distribution system. Culverts, of course, are expensive to build; consequently not too many were found, though ditch crossings, where traffic was heaviest, usually had small bridges to prevent the breaking down of the ditch banks.

As these farms have only been established for (at the most) three years, they are still more or less "in the rough". Each settler's idea of a farm varies, of course, but the two winning farms and the runner-up demonstrated better the requirements of an ideal dairy farm than the others. The amount of permanent improvements was greater and a more pronounced air of prosperity seemed to prevail.

As might have been expected, these settlers, coming on to new farms, met with many problems to which they were not accustomed, even though they had had previous dairying experience. Irrigation, for instance, had to be mastered, and considerable skill and ingenuity was called for in laying out the farms for convenient watering and in providing temporary appliances for carrying out the multitudinous operations not associated with dry-area farming.

There is one other point in particular, however, which required urgent attention when these settlers commenced milking and supplying cream to the butter factory. The fact that cream could only be sent to the factory three times a week(a considerable distance by train) rendered it necessary to adopt suitable methods of storing that cream between whiles. After being continually "second-graded," some of the settlers succeeded in contriving from improvised conveniences systems of cooling and storing, which for ingenuity could not have been improved upon by farmers anywhere. In this connection the winning farm stood on its own, though Mr. McKissick achieved the same object in a slightly different manner.

If these settlers will put the same initiative into developing other branches of their farms, there is not the slightest doubt that they will meet with the same success, with proportionate benefit to the big dairying industry which the area should one day support.

"Telephone Facilities in Country Districts."

A publication that will doubtless prove of considerable interest to many farmers is that recently issued by the Postmaster-General under the title, "Telephone Facilities in Country Districts." This is a booklet of some thirty pages, published with a view to placing before country residents the terms and conditions under which such facilities may be obtained. Considerable space is devoted to a description of exactly what is required where the line is to be partly or wholly erected by the applicant, the conditions being clearly laid down and the method of construction made understandable by the aid of numerous illustrations. The installation of telephones and the maintenance of lines and instruments by subscribers are the subjects of other useful chapters. Residents of New South Wales desirous of obtaining a copy of this booklet should apply to the Deputy Postmaster-General, Sydney.

Corowa Fallow Competition.

L. S HARRISON, Senior Agricultural Instructor.*

THE fact that fallowing is essential to the successful cultivation of wheat in the Riverina is being recognised, and competitions such as that conducted by the Corowa P. A. and H. Society, will do much to cause the signal advantages of the practice to be appreciated throughout the district.

This was the first attempt of its kind in the Corowa district, and the remarkably good response must have been particularly gratifying to the Corowa Society, who were responsible for its inauguration. Twenty-five fallows were seen. The area submitted had to be at least 100 acres in extent, and situated within 25 miles of Corowa. The fallows were to be judged on a scale, as follows:—Moisture, mulch, freedom from weeds, consolidation, and cultivation, each 30 points, making a total in all of 150 points. Judging took place on 4th, 5th, and 6th of April. So interesting were the fallows that photographs were taken of the best with a view to publication, but unfortunately the negatives were lost.

The judicious selection of implements and the use of them at the right times are the most important factors in preparing a good fallow, combined with the use of sheep for the control of weeds and improvement in consolidation. Viewing the fallows right through, there were some that, with a little more attention in using the right implement at the right time, could have reached a high standard. It may be mentioned that the use of sheep was considerably curtailed this season by the almost entire absence of growth on the fallows.

The majority of the mulches were too fine by far, thus laying themselves open to surface consolidation after rain, and providing an inefficient break to evaporation as compared with a rougher and more cloddy surface. It was most noticeable that the spring-tooth cultivator was rarely used, but where it had been, taking into consideration the very few cultivations of any description that the fallows received, the result was mostly decidedly to the fallow's advantage. The comparatively small disparity between points was due in a certain degree to the almost uniform points allotted for moisture and freedom from weeds, and while consolidation was found somewhat rarely, it had, where present, a marked effect on the result in points, as will be readily appreciated. It is admitted that the season could hardly have been more adverse from a fallowing point of view, as the rainfall had been for months extremely light, and the district was considered to be in an abnormally dry condition. After consideration, when it was found that the moisture varied only in relation to the retentiveness of the subsoil, it was decided to allot one-fifth of the points to each competitor for moisture.

*With the permission of the Minister for Agriculture, the services of Mr. Harrison were made available to the Association in the capacity of judge.

The winning fallow was entered by Mr. F. Tyrell, and secured a total of 98 points. This was in good order, but the surface was too fine. However, the paddock had been in cultivation for a very long time, and discing in February accentuated this fine surface condition.

The points allotted to the leading fallows were as follows:—

DETAILS of Awards.

Competitor.	Moisture. Max 30.	Mulch. Max. 30.	Freedom from Weeds. Max. 30.	Consolidation Max. 30.	Cultivation. Max. 30.	Total.
F. Tyrell	6	23	27	22	20	98
J. Nangle	6	25	28	6	28	93
T. Gillchrist and H. Hay and Sons ...	6	22	29	10	26	93
J. Willis	6	20	27	23	15	91
J. Gillchrist and H. Hay and Sons ..	6	24	29	8	24	91

It is suggested that future competitions of a similar nature be combined with the growing crop competition.

THE MOISTURE REQUIREMENTS OF WHEAT.

IN experiments made to ascertain the amount of water lost by transpiration from ordinary farm crops Hellriegel's observations show that for wheat 453 tons of water are required for each ton of dry matter produced. On these figures, which can be taken as well within the mark for Australian conditions, a 20-bushel crop would transpire equivalent to 6 inches of rainfall, and a 30-bushel crop approximately 9 inches rainfall. The actual rainfall would need to be considerably greater, as evaporation from the soil and loss from other causes must be taken into account.—A.I.F. Education Service, Land Book No. 4.

WHY SOME FARMS PAY.

A STUDY was made in Walworth county under the direction of P. E. McNall to determine why some farms paid, and to learn, if possible, to what extent it is desirable to supplement the dairy with other lines of income. It was found that the two outstanding ways in which the farms that made money differed from the others were the increased number of sources of income for income for the farm and the greater production of the dairy herd. The well diversified farms, or those having four or five sources of income of more than 100 dollars each, made considerably more than the poorly diversified farms. In order of their importance the chief incomes were obtained from dairy products, hogs, young cattle, poultry, grain, hay, and truck crops. The less diversified farms depended almost altogether upon dairy products for their income.—Report of the Director of Wisconsin University Agricultural Experiment Station.

Bulk Handling of Wheat.

F. J. SUTTON, Foreman, Sydney Terminal Elevator.

THE bulk system is universally recognised as the most economical method known of handling grain, and in New South Wales during the seasons 1920-1 and 1921-2, although operating under the most adverse conditions possible, it substantiated beyond question the economy and efficiency claimed for it.

Construction work insofar as the present scheme is concerned is now nearing completion, but before the advantages of the system can be secured to both seller and buyer, it is necessary to deal with the questions of control, grain grading, and financing.

It has been freely stated, and has even been asserted in the local press, that the Governments of other wheat-exporting countries do not own, operate, or control elevators or the grain trade. This is absolutely incorrect. In America and Argentine the Governments do operate State-owned elevators. In South Africa, Bulgaria, and the Pacific Coast States the Governments are at the present time constructing State-owned elevators, and plans are on foot to construct them in India.

The Canadian Government owns and operates elevators with a capacity of 16,000,000 bushels, and absolutely controls every country or terminal elevator, and every dealer and commission agent in the Dominion. From 1906 to 1911 Canadian farmers, dealers and exporters carried on a continuous and extensive agitation for the Government to take over and control all elevators. Sir Robert Borden toured the country advocating it, and promised that if returned to power the Canadian Government would either acquire them or control them. The latter was the method adopted in the Canada Grain Act, the enormous amount of ready money required to purchase the existing elevators being a stumbling block.

New South Wales is not faced with this difficulty, as the Government has provided the money for the construction of the whole of the elevators.

How the Canadian System is Controlled.

Every person, firm, or corporation owning or leasing a country or terminal elevator, and every commission agent or dealer must, on the first day of September in each year, obtain from the Board of Grain Commissioners a license to operate. Before receiving a license they must give to the Board a bond for from £1,000 to £75,000, the sureties of which have to be approved by the Board.

On 1st September in each year the Board make and issue all rules and regulations governing the operation of all elevators, grain dealers, and commission agents, covering the receiving, storing, cleaning, shipping, insuring, and otherwise handling of all grain, and set out the maximum charges

that are to be made for all work performed. No person is permitted to handle, deal, or trade in grain unless licensed and bonded, and all persons so licensed must keep books and records approved by the Board.

Through its inspectors and weighmen the Board supervises the weighing, handling, grading, and storing of all grain. Any seller or buyer may make complaint to the Board if he considers he has received unjust weights, grade, or dockage, or has been otherwise discriminated against. The Board are compelled to investigate all complaints and have power to order redress and impose fines. Operators of all elevators are under penalties of fine and loss of position for any infraction of the Grain Act or the rules and regulations, as are also any persons attempting to influence any operator to commit an infraction of them. All elevators have to forward to the Board, under oath, statements of all grain received, stored, and shipped. False statements carry heavy fines. Failure to pay fines assessed, or to carry out the Board's directions as to redress, incurs cancellation of license, forfeiture of bond, and in many cases imprisonment.

All interior storage elevators and terminals are weighed up and audited annually by the Board's inspectors, and all scales are under the direct inspection and supervision of the Board's chief weigh-master.

The foregoing outline clearly shows that the Canadian Government not only operates elevators, but completely controls the handling of all grain by private interests, and it is acknowledged that nowhere in the world are the interests of seller and buyer alike so carefully watched over.

Grain Grading and Financing.

Wheat, like any other commodity, possesses a standard of value, and the object of grading it is to give to the grower the full value of the product he produces and to the buyer the value of his gold.

In Canada the grading is done entirely by the Board's inspectors, who are appointed only after passing rigid examination as to ability. Although these inspectors are employed by the Board they must themselves furnish bonds. Four grades are defined by the Government, and these are changeable only by Act of Parliament. Each has certain specified qualities from a marketing point of view.

Other commercial grades are set annually by a Grain Standards Board to meet crop conditions. Every bushel of grain (be it wheat, oats, barley, rye, or flax) shipped out of the country or delivered to consumers in the country, carries the Government's written guarantee of weight and quality, and is convincing evidence to the buyer that the quantity and quality he pays for is in the goods delivered.

To the grower this system of classification according to the milling value of the product is of paramount importance. When he delivers up his crop to an elevator, he obtains the independent judgment of an experienced and impartial inspector who is not concerned in the profit of any transaction. If the grower disagrees with the ispector's grade he can submit the sample to the chief inspector, and if still dissatisfied he can submit same to the Board of Appeal.

After obtaining the grade to guide them, if growers can sell on sample at a price above that being offered for the grade given, they are perfectly at liberty to do so. When the farmer is satisfied as to grade, his wheat is received into the elevator and weighed under his own supervision. He then receives a document showing the quantity and quality of the wheat he delivered. This document is accepted by all banks as collateral—in other words, it is a negotiable document. The bank knows that the quantity and quality specified on the document is guaranteed by the Government, while the Government, in turn, is protected by its system of bonds and its control of the grain. Thus the trouble of financing crops, no matter how large. is overcome.

Farmers, when they have received their documents, can sell immediately, or can hold them and sell when the market suits them. If they require an advance on their grain all they have to do is go to the bank and obtain it. Shippers and exporters, as soon as their cargoes are loaded, can deposit the weight and grade certificates along with the bills of lading and collect their money, and are therefore relieved of the worry of loss due to shortage and reclamations.

For the convenience of farmers the Board file daily for public inspection the price of grain in the markets of Liverpool, London, and Glasgow. The Canadian Government does not in any manner, shape or form interfere or engage in the marketing of grain, recognising that the grower is entitled to sell his product where, when, or at what price he likes. As soon as the grower receives his receipt he becomes his own speculator, secure in the knowledge that the quantity and quality of the grain he is holding cannot depreciate.

If farmers wish to pool their grain, there is absolutely nothing in this system to prevent it, or to affect it. All the grower has to do is to forward his official documents to his co-operative company, who will deposit them in the bank and forward to the owner the amount of advance arranged for.

The Injustice of the f.a.q. System.

The injustice of the f.a.q. system to the farmer who grows wheat of good quality is notorious, but a few illustrations by way of indicating the necessity for proper grading may not be out of place.

A farmer delivering soft white wheat, weighing 59 lb. to the bushel, receives exactly the same price as a farmer delivering hard white wheat weighing 62 lb. Hard red wheat weighing 60 lb. to the bushel is certainly worth more than soft white wheat weighing 60 lb. to the bushel, but under present conditions the farmer receives no extra for it. Dirty grain brings just as much as clean grain, and the farmer who delivers grain containing smut balls receives exactly the same price for it as the farmer who delivers grain absolutely free from smut. In the present season grain that is bleached and weathered, so long as it weighs 59 lb. to the bushel, brings just as much as sound hard red, or sound hard white, grain weighing 62 or 63 lb. to the bushel.

These illustrations of injustice could be multiplied almost indefinitely, but they conclusively prove that farmers are not receiving individually the value of their product, and the farmer who grows grain of good quality is being severely penalised.

It might be assumed that when shipping these various qualities oversea in bulk the European buyer pays the same price as he would if the grain was shipped according to quality and in a good condition. This is absolutely wrong. In the past there have been cases where cargoes have been subjected to a cash dockage on account of its containing hard red wheats, not because this class of wheat is worth less, but simply because European buyers do not want red wheat mixed with white wheat. I have no hesitation in saying that on account of the low moisture content our red wheats will, under a proper system of grading, command a premium over the red wheats of Canada. The price of hard white wheats is undoubtedly prejudiced according to the quantity of soft white wheat contained in the ordinary shipment.

Buyers from years of experience know that our grain is shipped in a dirty condition, and they also know that the smut balls the wheat contains will become broken in transit and thereby contaminate the other wheat, and when purchasing they therefore base their price for f.a.q. on these contingencies. In addition to losses in low prices and reclamations there is the loss due to shortage in weight, as this State has to accept the weights from overseas.

These matters—and there are many more—not only inflict an injustice on the growers, but prejudice their products and the interests of this State in the world's markets. The Canadian farmer, prior to the inauguration of Government control (which, as pointed out, was installed at the request of growers, dealers, and exporters), suffered all the injustice and hardship that is now being placed upon the farmers of New South Wales. To remedy these evils and give to our growers the privileges and protection now enjoyed by the Canadian growers simply means the adoption of a grain grading and handling system, under Government control. A financing system will be automatically created in due time.

To Intending Growers of Pop Corn.

Intending growers of pop-corn are advised to make sure that the district in which they are located is suited not only to the production of the crop, but, if necessary, to it being held on the farm pending a favourable market. On the tableland, for instance, the product suffers no detriment from being kept for a while, but this does not apply at many places on the coast. It is recommended, therefore, that pop-corn growing be confined to the tableland districts unless growers can get a guarantee from the manufacturers to take the product when it is ready to market. It is thought that, in any case, the tableland districts will be able to supply the whole of the market requirements.—H. Wenholz, Special Agricultural Instructor.

Standards for Wheat.

E. HARRIS, Officer-in-charge (Acting), Bulk Handling Branch.

The following standards for wheat have been recommended by the technical officers of the Departments of Agriculture of Queensland, New South Wales, Victoria, South Australia, and West Australia. They are now referred by the Hon. F. A. Chaffey, Minister of Agriculture, for consideration by the growers, millers, wheat exporters, and the grain trade generally:—

Standards for Wheat for Australia.

Class 1.—*Australian White Wheat.*—This class shall include white wheat which shall be opaque in character.

Class 2.—*Australian Hard White Wheat.*—This class shall include white wheat which shall be translucent or vitreous in character.

Unclassified.—This shall include any wheat which cannot be included within Classes 1 or 2.

Grade Requirements.

Australian No. 1 *White Wheat* shall consist of at least 95 per cent. of sound white milling grain, bright in appearance, cool and sweet, and free from any commercially objectionable odour. It shall weigh (*when free from dockage*) not less than 63 lb. per Imperial bushel, and shall contain not more than 2 per cent. of damaged, other than broken, grain.

Australian No. 2 *White Wheat* shall consist of at least 95 per cent. of sound, white milling grain, cool and sweet, and free from any commercially objectionable odour. It shall weigh (*when free from dockage*) not less than 60 lb. per Imperial bushel, and shall contain not more than 4 per cent. of damaged, other than broken, grain.

Australian No. 1 *Hard White Wheat* shall consist of not less than 95 per cent. of sound, white milling grain, translucent or vitreous in character, bright in appearance, cool and sweet, and free from any objectionable odour. It shall weigh (*when free from dockage*) not less than 63 lb. per Imperial bushel, and shall contain not more than 2 per cent. of damaged, other than broken, grain.

Smutted Wheat shall consist of wheat which has a distinctive odour of smut, and shall be graded and designated according to the grade requirements of the standard applicable to such wheat if it were not smutted with the addition of the word "smutted."

Sample Wheat shall consist of any wheat not graded in accordance with the foregoing standards, and which is to be sold in accordance with its specific character and condition.

Growing Maize Provides Feed for Sheep.

The crop illustrated was grown on Mr. T. C. Weedon's farm, South Gundagai. The lower leaves were cleaned up with sheep, the feed on the 25 acres of maize being sufficient for 300 Merino weaners for one month.

It is considered that such grazing does not affect the yield of the maize for grain very much, if at all. The cobs are mostly out of reach of the sheep (Merino weaners), which are turned into the crop just before the bottom leaves naturally die off. From this particular crop, 90 bushels per acre were harvested, in addition to the sheep feed.—H. Wenholz, Special Agricultural Instructor.

Immigration.

It will no doubt be of interest to farmers, agricultural employees, and others living in the country districts, to learn that the Government has approved of a liberal extension of the facilities available to residents of New South Wales for securing assisted passages for relatives and friends resident in the United Kingdom. Hitherto, persons were only able to nominate close relatives, but a nomination may now be effected in favour of any person for whom it can be shown that satisfactory provision can be made by the nominator. Organised bodies, such as religious denominations and clubs, will also be permitted to effect nominations, and the matter of the selection of the persons or families for whom provision can be made by such bodies may be left in the hands of their representatives in the United Kingdom. By this means it is hoped that community settlement might be brought about. It is not essential that the passage money should be paid by the nominator, but a deposit of £5 as a guarantee for the fulfilment of the conditions of nomination is required. This will be refunded when evidence has been produced of the satisfactory settlement of the nominee.

Dairying under North Coast Conditions.

A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

It is generally advisable to have the heifers freshening while still quite young. Left too long before being joined with the bull, heifers of the heavier breeds develop a beefy tendency, which early maternity checks, while with all breeds the fact of coming early to the pail develops the mammary glands and encourages a deeper milking habit.

The heifer should therefore be put to the bull at about 15 months old, and she will then drop her calf at 2 years old. A heifer on her first calf should be kept in milk as long as possible, even if she is only giving a small quantity of milk, for a short lactation period at this stage tends to form a habit in subsequent milking periods.

During the period of gestation the heifer should be liberally fed on the lines indicated in the article of this series that appeared in April.

Few farmers fully appreciate the importance and value of systematic treatment at milking time. Far too often the cows are herded up to the bails by dogs—a habit that is most pernicious by reason of its effects on the animal's nervous system, with which the secretion of milk is most intimately connected. In the bails, too, they are treated gently enough in many cases no doubt, but without method.

To get the best results the herd should be quietly driven up to the yards and kept there with as little to disturb them as possible. They should be milked by the same man in the same order every day, and they should be thoroughly milked out every time, on the principle that the more milk is drawn the more the milk-producing organs are stimulated. A gentle and expert milker is worth a good deal. He can clear the udder with greater ease than a rough or less experienced person, and he will do it with more comfort to the cow.

Of cleanliness we have heard a great deal, and it is not necessary to repeat it all here, but the importance of clean hands, kept clean throughout the milking, and of wiping the udder and teats with a damp cloth before commencing to milk, may be once more emphasised.

After being milked, the cows should be passed straight out to pasture, and not be turned back into the yard to wait till the whole herd has been milked. The effect is to avoid loss of feeding time, thereby enabling increased production, and to reduce the likelihood of injury by horning in the yard.

A good deal of space was devoted in one article of this series to the subject of feeding as a means of increasing production. It is worth adding that an ample supply of good water is scarcely of less importance. The habit of drinking plenty of water has such an influence upon milk production that in winter American herd owners slightly heat the water supplied to their cattle,

in order that it may not be so cold as to deter them from drinking freely. How great then is the importance of water in the heat of summer in New South Wales, and how good the reason for presenting clean, cool, attractive water at a time when an ample consumption should be encouraged in the farmer's own interest.

Principal Breeds of Dairy Cattle.

The conditions that affect dairying vary so greatly, even within comparatively short distances, that many things must be considered in the selection of the breed of cattle most suitable for a farm. The soil, the pasture, locality, and climate, together with the object in view (whether milk, butter, or cheese), must all be considered in making a choice. No single breed can be regarded as superior to all others. One may excel in certain features, but not in all. It is necessary, therefore, to select the breed that comes nearest to meeting the conditions.

Personal preférence is a real factor in choosing a breed - occasionally it is the only thing considered, with disappointing results—but conditions and objectives should have place, and, necessarily, the price-level for the time being. Nearly every breed has its "boom" period, when the ordinary farmer finds it expensive to buy in; but so, too, nearly every one has its period of depression when it is difficult to quit surplus young stock, a profitable side line from every good herd. Even the pure-bred bull that is to be used for the grading up of the herd is therefore a matter of some moment in relation to the question of breeds.

The lines of cattle of good dairy quality have already been indicated, and it may be useful now to mention the characters of the different breeds that chiefly claim attention in New South Wales. There are six such breeds—Ayrshire, Guernsey, Holstein, Illawarra Milking Shorthorn, Jersey, and Milking Shorthorn. The order in which they rank in certain important respects may be presented as follows:—

Amount of milk produced—Holstein, Ayrshire, Illawarra Milking Shorthorn, Milking Shorthorn, Guernsey, Jersey.

Richness of milk—Jersey, Guernsey, Milking Shorthorn, Ayrshire, Illawarra Milking Shorthorn, Holstein.

Yellow colour of milk—Guernsey, Jersey, Milking Shorthorn, Ayrshire, Illawarra Milking Shorthorn, Holstein.

Size—Holstein, Milking Shorthorn, Ayrshire, Illawarra Milking Shorthorn, Guernsey, Jersey.

Early maturing qualities—Jersey, Guernsey, Illawarra Milking Shorthorn, Milking Shorthorn, Ayrshire, Holstein.

With reference to the amount of butter-fat produced there is very little difference between the breeds, the difference between individuals of the same breed being much greater than between the breeds themselves. High producing animals are common in each of the six kinds, and, unfortunately, low producers also. Brief descriptions of the different breeds follow.

The Ayrshire.

The Ayrshire breed was developed from the small black and white cattle indigenous to the County of Ayr, in Scotland, upon which was crossed at different times West Highland Blood. Guernsey and Teeswater cattle (the latter improved by the use of Dutch bulls) were also used in building up the breed. The mixed ancestry is evidenced to-day by certain well known points:—

1. The wide, deep, hindquarters point to the Shorthorn blood introduced in the Teeswater cattle.
2. The fine skin points to the Guernsey.
3. The general outline and high milking capacity are akin to the Holstein.
4. The ability to give milk from sparse pastures points to the West Highland relationships.
5. The natural shyness, with certain horn and hair characters, also indicate West Highland kinship.

The Ayrshire is the hardiest breed in Australia. Its native vigour and activity fits it for areas where the seasons are severe, and where it is necessary to travel to gather food. For the dairy farmer whose lands are broken and not fertile it is the best breed, yet it does relatively as well under better conditions. The average weight of the Ayrshire cow is 1,000 lb., or rather more.

Ayrshires have not achieved record yields as large as Holsteins, Guernseys, and Jerseys, but in average milk production they rank high, and when they have to travel any distance for their feed, or graze over broken ground, they give more milk than any one of the three breeds mentioned. In fact no dairy breed can be compared with them in ability to obtain a livelihood upon scant pastures.

The colour varies from a medium red to a dark mahogany-brown and white, with either colour predominating. Of late years there has been a tendency among breeders toward white with red markings. The muzzle is generally black and the switch white. The horns are long and prominent, turning outward, then forward and upward. A uniform square level udder, with long body attachment, is considered good form. The teats are frequently a little small. A shy, nervous temperament is generally characteristic of the breed.

The Guernsey.

The origin of the Guernsey breed is also more or less obscure. A book recently issued by the Royal Guernsey Agricultural and Horticultural Society, entitled "The Guernsey Cow: Her History and Records," states that about A. D. 960, some monks of St. Michel were sent from Brittany to found an abbey in Guernsey, and they imported cattle from the adjacent continent. It is assumed that the breed selected was that known as Froment de Leon, the animals of which are small, about the size of the modern Jersey, and much smaller than the Guernsey of to-day.

Some years after the advent of the monks, others came to the island from Cherbourg, a port of France, and brought with them the large Norman brindle, which is the common cow of the rich butter-district of Isigny. The Isigny is a larger animal than the modern Guernsey, and said to be a heavy milker, many animals producing 60 to 65 lb. daily on native grasses, without any artificial feed. The milk is of very high quality and deep colour, and the brindle and black markings so often found in the present day Guernsey are characteristic.

It is therefore considered reasonably evident that the Guernsey has been established by crossing the Norman brindle, or Isigny, and the Froment de Leon.

The Guernsey is better adapted to a temperate, mild climate, such as that which obtains in its native islands in the English Channel, but good herds have done well in climates such as Quebec, in Canada; and some of the world's records have been put up in the State of Wisconsin, U.S.A., a very cold climate. They are not adapted to poor pastures and hilly country. On their native island they have for hundreds of years been tethered on good pastures, and, like Jerseys and Holsteins, they are specially adapted to a combined system of soiling and grazing.

Cows that are discarded from the dairy have some value for beef, and the steers grow into fair-sized bullocks.

The Guernsey has deep and prolonged milking qualities, and the cost of production of the milk is low. On the average the milk is richer than Jersey milk, and of a superior rich colour, with a fine flavour. Guernseys are especially valuable for crossing. They produce milkers of good size and capacity when crossed with the Illawarra Milking Shorthorn, and, in fact, they cross well with any cows of mixed breeding. At Wollongbar Experiment Farm, where the Department's Guernsey herd is located, the cows prove capable of utilising large quantities of food to the best advantage, and the average butter production of the herd is now 401 lb. per cow. At the farm it has proved hard to dry the cows off. The average of the bulk milk of the herd gives a test at the farm of 5·4 per cent. butter-fat. One cow, Parson's Red Rose 20th (on first calf), has just completed an official test of 273 days and yielded 8,977 lb. milk, equal to 584 lb. commercial butter. This yield is probably the biggest ever put up for a cow of that age (two-year-old class) in Australia. The significant thing about this animal is that her dam was 16 years old when the calf was born, and though now over 18 years old, is still breeding regularly. This is another illustration of the wonderful constitution of the breed.

The characteristic colour varies from a deep reddish or brownish fawn to a very light orange fawn. An orange fawn with white markings, the fawn predominating, is perhaps the most common. The under parts of the body, and the legs and switch are usually white, while a buff nose and amber-coloured horns are typical.

Guernseys have a nervous disposition, but are quiet and gentle if properly handled. In size the cows average 1,050 lb. There is some resemblance to

the Jersey, but the Guernsey is larger, slightly coarser in the bone, and has a deeper body, the head also being longer and narrower than in the case of the Jersey. The breed is hardy, and free from disease.

The Holstein.

Little is known about the origin of the Holstein-Friesian—to give it its full name—but it is no doubt a descendant of the larger ancient ox, *Bos taurus.* It seems to have been bred pure for several hundreds of years in the province of Holstein, which, as early as the 9th century, was famed for its dairy products. The improvement of the Holstein has been brought about to a great extent by the unusual succulence and productiveness of the pastures of its native land.

The large capacious frame of the Holstein calls for an environment where the land is level rather than broken, and rich in forage and grain crops. They are heavy feeders, especially of roughage, and do best when plenty of feed is easily available, their large frame forbidding them travelling over large areas for it. Under such conditions the breed is well adapted to provide milk for cities and cheese factories.

In milk production the Holstein is without a rival, but the milk is not so rich in butter-fat as some of the other breeds.

It does not mature so quickly as other breeds, the heifers usually becoming productive at 24 to 30 months old. In crossing, its marked prepotency is apparent in the distinctive colour markings of the progeny. The breed is free from disease, and the calves are easy to rear.

The universal colour is black and white, the sharply-defined contrasts giving them a striking appearance. Either colour may predominate, but black below the knee is objected to. In disposition they are docile, even tempered, and not excitable. The average weight of the cow is 1,200 lb.

The Milking Shorthorn.

The most popular breed in Australia is the Milking Shorthorn. It was first introduced into New South Wales many years ago, and its development has been along two main lines, the result to-day being the existence of two very distinct types. The first of these two lines may be said to be the English Milking Shorthorn, preserved to this day as a pure bred, any admixture of other blood being strictly discountenanced. The other line of Shorthorn is a distinct type, which is the result of a certain amount of crossbreeding several generations back, but which is esteemed by many breeders and farmers on account of the strongly-marked dairy characters the type exhibits.

The following descriptions of these two types are supplied by Mr. C. G. F. Grant of Berry Experiment Farm:—

"The Milking Shorthorns are probably more numerous than any breed of cattle in Australia. In size they rank alongside the Holstein, but when fattened for beef they weigh heavier.

"They date back to early English history, and have been kept on approved lines for many years, and quite distinct from the beef type. The colours are whole white or creamy white, whole red with slight markings, both blue and red roans. Red with white splotches is also to be seen, but it is not a favourable colour. The most popular colours are the whole red and distinctive rich roans. The horns should be strong and waxy, with a tendency to curve outwards, and then inwards and downwards. The forehead should be broad between the eyes, the head of medium length, the eyes prominent, and the nose free from black markings. The general conformation, although showing a perfect back line and width between hooks and pins, does not show the wedge when viewed from the side which is found in the Ayrshire. The constitution is always remarkably good, and the disposition of both cows and bulls quiet.

"On account of their size Milking Shorthorns should not have to travel far for their feed, and they require good feeding and proper attention in the winter months. They should not require so much hand-feeding as perhaps Jerseys and Guernseys, but they are apt to show the effects of shortage of feed during a drought period.

"Owing to the existence of both beef and milking types, there seems to be an occasional tendency to revert to the beef-producing strain, and it is therefore necessary to breed carefully from milk-producing strains, and to take care when hand-feeding that the rations are properly balanced to maintain the milk flow.

"The milking properties of the Milking Shorthorn may be said to be equal to those of the best breeds. The average production of a good herd should be 600 gallons per head per annum, with a test of 3·6 to 3·65 per cent.

"There is some tendency for Shorthorns to dry off after they have become in calf, and it is necessary to make it a rule with heifers on their first calves to milk them for at least six months after they are in calf. It is most important to establish a deep milking habit early in the history of every beast.

"With this breed it is wise to give ample time for the development of the frame. In the western districts of the State the heifers should drop their first calves at 2¼ to 2½ years old, but on the South Coast in particular it is well to have them calve when 3 years old. The young heifer must be kept growing, but must not be allowed to become fat until well in calf, as there is a tendency to barrenness when in too good condition.

"Milking Shorthorn calves make the best of vealers, and are always strong and easy to rear. When the cow's history as a milker is ended she is the best of all breeds to fatten off for the butcher."

The Illawarra Milking Shorthorn.

"When reviewing these cattle we are dealing with a type of Shorthorn which may be regarded as a purely Australian production.

"The value of 'made productions' in other branches of agricultural life is recognised by almost all farmers, but the fact that the I.M.S. cattle (as

they are commonly called) are a 'made' breed prejudices not a few farmers against them. No doubt, had we lived during those periods when other dairy breeds were being evolved, we might have seen a similar state of affairs.

"However, in the true Illawarra cattle, we have a very fine type of dairy beast upon which to work. Granted that local conditions may govern 'type' to a certain extent, the fact that with I.M.S. cattle we see what might be termed three types—viz., heavy, medium, and light—may not be a condition of affairs tending towards the improvement of the breed.

"Breeders of the Illawarra Milking Shorthorn have bred and still do breed principally for milk production, the idea of a dual-purpose beast having received little or no consideration. In comparison with the Milking Shorthorn we find that certain strong similarities exist, brought about, no doubt, by the fact that in Australia both breeds have a large amount of the same blood running through their veins. Yet there is a distinction between the two breeds, and that distinction should be universally recognised.

"The Illawarras are, on the whole, slightly smaller in frame and finer in bone and horn, and show a more definite 'dairy' type, as understood by the average farmer, than the Milking Shorthorn. The head is longer and slightly narrower, while the neck is finer and more often than not shows a 'ewe' shape. With a perfect wedge-shaped appearance, and an enormous udder development, the Illawarra rivals the Ayrshire as the ideal type of dairy beast.

"In colour they are similar to the Milking Shorthorn. The societies connected with both breeds include whole white in their standards, but in the case of the Illawarras (as indeed with the Milking Shorthorns) whole whites are not in favour with breeders. Blood reds with slight white markings, and rich red roans are the most popular colours.

"As producers, the Illawarras rival the Milking Shorthorns, but as yet have not outdone them. They are not given to "laying on flesh" while in milk, and though it is considered that the Milking Shorthorns are more suitable for the flat lands adjacent to our main rivers, the I.M.S. give the best results in the more hilly country.

"As has been found with other breeds, line breeding for production has been the means of producing some of the finest specimens of this breed. The influence of the sire is an all-important factor that has yet to be appreciated by many farmers.

"More universal judging, towards a standardised type, together with a more careful selection for registration in the Herd Book, would be the means of both improving and establishing these cattle as a distinct breed."

The Jersey.

The Jersey breed, as is well enough known, originated on the island of that name, having been descended (it is supposed) from the native cattle of Normandy and Brittany. It has been claimed that they have been bred with

little or no admixture of foreign blood for 500 years. In Jersey they are pastured all the year round, being outside night and day from May to October, and being housed at night in winter when the grass pastures are liberally supplemented with hay and roots.

The Jersey is noted as a butter cow and for the richness of her milk. She is small in frame, but not having such a capacity as the Ayrshire or Kerry for gathering food is therefore not so suited for sparse or rugged pastures. In form the Jersey is small and deer-like, the average weight of the mature cow being rather under 900 lb.

The breed shows a great adaptability, and matures very quickly—in fact, no other dairy cow matures so quickly—the heifers usually coming in at two years, and sometimes even earlier. For best returns the Jersey cow should have rich pastures, though she will do quite well on average pastures, especially if they are supplemented with soiling crops.

The Jersey is particularly useful for crossing and grading up a herd, and good results have been obtained from the Jersey-Shorthorn cross. At the same time no cross or grade is so good as the pure bred Jersey.

The chief weak points of the Jersey are the small size, lack of width through the heart in some cases, and a tendency, here and there, to delicate constitutions.

Compared with the Jersey, the Guernsey cattle are less clean cut, less handsome, coarser in the bone, larger in every way, and plainer in the head.

The Jersey is generally very adaptable to both hot and cold districts, and probably there is no better special purpose dairy breed for Australian conditions, but it is not advisable to put them on wet, badly-drained country.

Jerseys vary considerably in colour. Various shades of fawn, grey, and very dark-brown are common, and where these colours are broken, white is mixed with them. The muzzle and tongue are usually black or lead coloured, and it is common to find a light or mealy ring round the muzzle. Black switch, horns small, waxy and frequently tipped with black. The temperament is distinctly nervous and often somewhat excitable, but the highly organised nervous system enables a quick response to good treatment and abundant feed.

The Principle of Corrective Mating.

Side by side with the principle of breeding only from the best, it is important to practice "corrective mating." Practically all animals have definite and distinct faults. Many have good points equally definite and distinct. The art of the breeder lies largely in judicious mating to correct faults and to perpetuate good points. Only experience and close study will develop the instinct that enables a breeder, by corrective mating, to build up the type he desires.—A.I.F. Education Service, Land Book No. 2.

Successful Dairying.

G. ROWE, Dairy Instructor.

Two of the factors necessary to successful dairying are a dependable and sufficient supply of feed, and ample water. Wherever dairying is attempted and these factors do not exist the results cannot be satisfactory.

A dependable feed supply is one that is always available, so that the dairy-farmer will not at any time be short of feed. It is not long ago that many farmers on the coast found themselves so short of feed that many cows had to be disposed of and many died from starvation. This was due to the droughty conditions that existed at the time, and also to the fact that no provision had been made to carry the herds over a period of depleted pasturage.

That was a great set-back to the dairy-farmers and to the industry, but it is from experiences like it that farmers learn the necessity of providing for dry spells by making ensilage or hay when the seasons are favourable. The dairy cow must have her feed every day in correct kind and quantity to insure her maximum work.

Nature has been very kind to dairy-farmers in this State, providing ample feed for all normal conditions, but there is one direction in which his success depends entirely upon his own ability and common sense—that is in the selection of good producing animals. If he fails at that point it is due to himself.

There is a vast difference in the cow that will produce 130 lb. of butter-fat and even less, and one that will produce 400 lb. and more. Yet how many dairy-farmers still guess at the individual results of their cows! Testing the milk to determine the butter-fat is the only way to find the profitable cows in the herd; it is a method that is full of interest and surprises to the thinking man, and it is also accompanied by good financial results because it discovers the cows that are not worth keeping.

Testing must either be conducted by the farmer himself, or by a man employed for the purpose, and the latter may be very simply and inexpensively accomplished by joining a district herd-testing unit. Testing costs very little, but the value of the information is great indeed, and the results at times so astonishing that one can scarcely realise the truth.

As the result of testing and culling, some farmers have increased the production of their herds 50 per cent., and that in a very short period, but it is never done until the individual cows have been tested, the records written down and studied, and comparisons made with a view to locating the non-profit makers—the ones that are best sold to the butcher.

When the unprofitable cows have been found by the aid of the testing machine, it becomes a question of some concern to the dairy-farmer how he is to get more good animals to replace the culls from his herd. There are two ways—to purchase them, or to breed them.

To purchase them would be the simplest way, providing the dairy-farmer had the capital and could find a breeder prepared to sell the progeny of tested stock. Most breeders, however, are disinclined to sell their best heifers as they require them for their own herds. The farmer, therefore, has usually to make up his mind to breed his own young stock, and he should begin by purchasing the best pure-bred bull he can afford. It is sound business to pay a good price for a good animal, even up to £40 or £50. If possible, the butter records of the dam and grand-dam should both be available.

With the remaining cows in the herd—all good ones—the dairy-farmer should now be well on the way to the establishment, within a reasonable time, of a very profitable herd. Instances are on record where the female descendants of a pure-bred bull have doubled the yield of the herd in the first generation. On the other hand, a grade animal purchased at a cost of a few pounds will often reduce the productive value of a herd.

One of the active sources of loss in many dairies is the careless, and often incompetent, milker. Milking is a simple operation, but to some it is a laborious and irksome task, and is apt to be rushed through as quickly as possible, no care being exercised in the stripping of the cow. Cows that are not stripped out regularly soon go off their milk, and in a short time become dry.

Most cows respond wonderfully to a good milker and resent a poor one. Where possible an animal should be milked by the same person during the whole lactation period.

The production of milk is a physiological function and the nervous system of the cow should never be excited. At all times she should be kept quiet and undisturbed, and she should be quite at ease during the milking time.

Reform of Agricultural Weights and Measures.

On the 1st of January of this year there came into operation in England the Corn Sales Act, under the provisions of which the sale of corn (grains), pulse, seeds, potatoes, and mill offals in any quantity of 112 lb. or more, must be by the hundredweight, and sales by the quarter, bushel, sack, and various local measures became illegal.

The Act bringing about this important reform, says *Modern Farming* in the course of a congratulatory article, is the result of a private bill introduced into Parliament by Mr. David Davies and a few other keen agriculturists. The journal quotes Mr. Davies as follows: "People have been tinkering with the reform of agricultural weights and measures for over a century. There was a good opportunity in 1889 when the Government of the day made it compulsory to sell coal by weight, but corn was not included. . . . Yet every time a committee has given special consideration to the subject they have reported in favour of selling agricultural produce by weight, with the Imperial hundredweight as the legal unit."

It appears that in the sale of wheat alone twenty-five different weights and measures have previously been employed, and that there were in use no less than twelve different bushels, seven gallons, thirteen pounds, ten stones, three hundredweights, and nine tons. The advantages of the new method will therefore be of almost universal application.

Calf Rearing.

H. D. BARLOW, Senior Dairy Instructor.

THERE is no doubt that the rearing of the calves is one of the most important activities on a dairy farm. To a great extent on success in this depends the standard of the herd in a few years' time. It should be the aim of every dairyman to keep on improving his herd, and it is essential, therefore, that such an important item should not be left to chance and the survival of the fittest, but that every effort should be made so to rear each individual calf that it may develop into a strong, healthy, productive animal.

It is a well known fact that if young animals are checked in their growth, whether through lack of feed, bad feeding, or disease, they seldom, if ever, develop as well as they should. This is particularly applicable to calves, and to a great extent it is the cause of so many of the weedy, under-sized, under-developed cows which are to be seen. On far too many farms the feeding of the calves is looked upon as an irksome necessity, with the inevitable result that the development of the animal suffers. There is no reason, on the other hand, if trouble is taken to understand the why's and wherefore's of the matter, why the work should not be exceedingly interesting and something of a pleasure.

The first thing to remember is that the calves of to-day represent the herd of to-morrow, and the value of the herd will depend to a very large extent on the manner in which the calves are reared. To rear calves satisfactorily does not mean that they shall be just kept alive until they are old enough to look after themselves, and then be turned out. It means that they shall be so fed, looked after, and attended to that they will continue in good health and keep on growing and developing, and that if they do by chance get sick, the person looking after them shall know what to give them and how to treat them, so that they may rapidly recover without their growth and development being checked.

Let us take the calf from the day it is born, and examine the reasons for the different methods of treatment and feeding.

In the first case, it is advisable to leave the calf with its mother for a sufficiently long time to allow it to have a few drinks, and also to give the cow time to lick it clean. As a rule, this period should not extend beyond forty-eight hours at the most, unless the calf is very weak. If a longer time is allowed, the cow will fret when the calf is taken away, while the latter will have become correspondingly dependent upon its mother, and will be much harder to teach to drink out of a bucket afterwards.

Always remember that young calves should be treated very quietly and never try to force them to feed quickly, or they will become frightened, in which case, even if they do feed, their food will not do them as much good and may even cause digestive troubles.

It is essential that the calf should be fed on its mother's milk for about four to five days. The reason for this is that the milk from a cow which has just had a calf is peculiarly beneficial for the calf, acting not only as a food but also as a medicine, cleaning out the calf's intestines and stomach and leaving them in such a state that when normal milk is fed the young animal is able to digest it properly. Since the natural way for a calf to obtain its food is by sucking the cow, it is advisable to let it get its food in much the same condition, which means that the milk should be warm and should be fed often and in small amounts. Under these conditions the calf is able to digest the milk more readily. As a general rule, if milk is fed at about 90 to 100 deg. Fah., it will be found satisfactory, provided that care is taken that the young animals do not gulp their food, and that until they are a week old they are fed at least three times each day.

It is usually advisable to feed on full milk for about ten to fourteen days, but if the calf is at all backward or weak, it may be necessary to continue the full milk for a longer term. The amount of milk fed to a calf for the first week will depend on the size and health of the calf, but will vary from ½ gallon to 1 gallon per day. At the end of ten days, in the case of a normal calf, about a quarter of the total feed of whole milk can be replaced by clean, fresh skim-milk, and the amount of skim-milk can be increased daily, but the more gradually the better, as there is less chance of disorganising the calf's digestion. When three weeks old the calf may be receiving all skim-milk.

Be careful to remove all froth from the skim-milk before feeding it as froth has a tendency to cause the calf to scour. Since skim-milk has practically no fat in it, it is necessary to supply something that will take the place of the butter-fat, and this is usually done by the addition of linseed jelly and bran or some calf meal. Great care must be taken that this extra feed is added in small amounts to start with, the quantity being increased gradually until the full amount is in use.

When three weeks to a month old, it is a good plan to give calves a little chaff and crushed oats to pick at between feeding times.

It will be found, with experience, that if a calf can be reared satisfactorily until it is on skim-milk most of the trouble is over.

In good seasons, when the grass is good and the weather warm, well-grown and healthy calves can be weaned at about five months old, but if the calf is weak and food is scarce it is advisable to feed them longer. A calf from an exceptionally good cow, and calves from pure-bred or stud stock, should usually be fed for a longer time. Young bulls, which are to be kept for stud purposes, should be kept on skim-milk, &c., until 6 to 8 months of age or even older.

To rear calves successfully there are several important points to be remembered.

1. A calf from a good cow is always worth the trouble of rearing. A calf from a bad cow is seldom worth any trouble.

2. Cleanliness is absolutely essential, and to obtain the best results all buckets, milk, &c., should be as clean and well looked after as if they were to be used for the preparation of food for human consumption. This is a very important point, and it is certain that a very large percentage of calf diseases and troubles are directly caused by lack of cleanliness in some form or other. It is a good plan never to feed a calf from a utensil or with milk which you would not like to use yourself. If you can do this you will find that practically all the troubles which other people have will not worry you at all.

3. Feeding at irregular temperatures has the effect of upsetting the calf's stomach, and should be avoided as much a possible.

4. Feed regularly and in small amounts. When the calves are young, feed at least three times each day.

5. Treat the calves kindly, and do not unnecessarily frighten or hurry them.

6. Allow the calves to be in the open air as much as possible, and if a shelter is provided see that it is kept clean and dry. Do not let them lie on uncovered damp concrete, as they are then very liable to catch cold.

7. If a calf becomes sick, immediately separate it from the others and give it special treatment until it recovers, thus reducing the chance of the other calves getting the same trouble, and helping the sick one to recover more quickly.

8. Always remember that anything abnormal about a calf is bad, and do not think that it is necessary for a calf to have a "touch of scours" or a slight cold sometime. The calves that make the healthiest and most robust cows are usually those which have not been checked in their growth by digestive troubles or any other complaint when young.

9. A young calf's digestion is very delicate and is the cause of many complaints. Therefore, feed young calves with such food and in such a way that their digestions will not be overtaxed at any time.

10. If possible, use separate vessels for each calf to drink from, especially when young.

11. Get to know the breeding and the prospective value of every calf. Each calf will then have an individuality, and better results will be obtained.

Physical Condition and Soil Productivity.

The physical conditions of the soil are of vastly more importance than the chemical condition, despite the fact that such large quantities of the chemical substances are withdrawn by a single crop. Deficient fertility, due to lack of the essential chemical substances, can be remedied comparatively easily and cheaply by an improved system of fertilizing. Deficiencies in the physical condition are often difficult and expensive to correct.—A.I.F. Education Service, Land Book No. 4.

"Efficient Marketing for Agriculture."

Although it is to be hoped that there may one day be made available to the Australian agriculturist a distinctively local work on marketing—a book written specifically for our conditions and based upon an appreciation of the local difficulties—any authoritative contribution on a subject of such importance is welcome. In the primary, as in the secondary industries, economical disposal of the product is of no less significance than economical production itself, and it is perhaps a sign of the times, and a widening recognition of the fact that successful farming must conform to the laws governing all other businesses, that the number of books on agricultural marketing is steadily growing.

"Efficient Marketing for Agriculture; its Services, Methods, and Agencies," is distinctly worthy of a place on this list. The author is Theodore Macklin, Ph.D., Professor of Agricultural Economics in the University of Wisconsin, who contributes in this book not only a quantity of constructive opinion upon every smallest aspect of his subject, but expresses it in a series of chapters arranged in such sequence that the least possible labour devolves upon the reader.

"Without attempting to say the last word on the subject," says the preface, "the author has selected and organised economic facts to show that marketing consists in rendering essential services, and that production is in no sense complete until they have been rendered. Someone must do this work, otherwise producers and consumers alike are bound to suffer. . . . The problem of marketing, however, is not likely to be solved until people generally realise the necessity not only of having necessary services performed, but of having them performed by the most efficient methods and by agencies that in functioning take a minimum share of the consumer's dollar. The subject is treated from the point of view of the common interests of farmers, consumers, and middlemen."

Professor Macklin admits the claim to existence of the middleman—that *bête noir* of many producers—and he classifies marketing agencies under the headings private, co-operative, and governmental, and contends that all have their legitimate functions. A particularly interesting chapter is that on the fundamentals of co-operative marketing, and another that in which the writer deals with Government authority in relation to marketing. As to the latter, he admits that there is some divergence of view about what the relationship of a Government should be, but he argues that it has very distinct responsibilities. Each of the nineteen chapters, however, is soundly instructive and suggestive, while numerous illustrations add to the value and interest of the 400 odd pages that make up a useful book.

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Angora Goats.

The Department is in receipt of correspondence from Mr. E. F. Lane, "Enalfern," Budgery, via Burgooney, suggesting the formation of a society of breeders of Angora goats on the lines of the American Angora Goat Breeders' Association. Mr. Lane is prepared to act as hon. secretary, *pro tem*, with that object in view.

The Destruction of Rabbits with Calcium Cyanide.*

MAX HENRY, M.R.C V.S., B.V. Sc., Government Veterinary Surgeon.

THE calcium cyanide used in the experiments described hereunder is a commercial preparation in the form of thin brownish flakes, that give off a strong odour of hydrocyanic acid gas.

It is claimed by the manufacturers that on exposure to the air there is left, after the hydrocyanic acid gas has been given off, only a harmless residue composed of hydrated lime, graphitic carbon, and salt. The length of time during which this material will continue to give off hydrocyanic acid gas is being tested, but it is undoubtedly somewhat lengthy, which is a factor of importance in considering the value of calcium cyanide for the purpose. It has been used in Canada in the destruction of gophers, the small burrowing rodents which in many parts of North America constitute a very serious and destructive pest. In the experiments detailed below the directions of the manufacturers were followed, due allowance being made for the difference in local conditions and in the habits of the rabbit and the gopher. Although the gas given off is lighter than air, it was claimed by the manufacturers that it would diffuse downwards through the burrow, even if only placed on the ground above the openings and covered with a tarpaulin. That method was not employed, being considered unsuitable to our conditions and involving a possibility of risk to live stock, but the gas was found to possess high diffusive power and to penetrate widely in the burrow.

A burrow apparently suitable for experimental work having been selected, from 1½ to 2 oz. of calcium cyanide was introduced into each opening with the aid of a wooden spoon about 15 inches long. The openings were then carefully blocked with dry cow-dung, leaves, or wood, to prevent earth falling in and covering the poison, and this protection was in turn covered with earth, to prevent, or at least check, the outflow of air and gas. Experience indicated that it is desirable to give some little attention to this blocking of the openings of the burrow, not only to ensure the maximum concentration of the gas inside, but to prevent opening up of the burrow from the outside. Quite a number of rabbits were found dead just inside, as though they had attempted to escape, but, owing to careful blocking, were unable to do so before being overcome by the effects of the gas. The burrows were opened up at different times, varying from one hour twenty minutes to ninety-six hours, subsequent to the introduction of the cyanide. There was evidence that the shorter periods were not sufficient to allow the gas to take effect

* Constituting a preliminary report of experiments carried out under instruction from the Experiments Supervision Committee of the Department of Agriculture.

under the conditions existing at the time and with the dosage employed, and for further work it is suggested that a minimum of twenty-four hours be considered as required to ensure the destruction of all inhabitants of the burrow.

The details of the experiments carried out so far are stated in the following paragraphs:—

The First Series of Experiments.

These experiments were carried out in rather hard, very dry, decomposing granite soils on a hillside They were disappointing, as it was evident after completion that very few rabbits were present, but they were useful educationally.

No. 1.—A small burrow with eight openings. Approximately 12 oz. of calcium cyanide was introduced into the burrow, 1½ oz. being placed in each opening at 9.50 a.m The burrow was opened up at 11.15 a.m. The odour of hydrocyanic acid gas was very marked, not only in the burrow but in the air surrounding it, when being dug out. Two living rabbits were found.

No. 2.—A burrow similar to No 1, but larger, the measurements between extreme openings being 36 x 27 feet. The cyanide was put in at 10.10 a.m.. 18 oz. being used. It was opened up between 11.30 a.m. and 2.50 p.m. The gas was well diffused, even at a depth of 3 feet. At 2.45 p.m. some of the calcium cyanide which had been put in was examined, and found to be giving off comparatively little odour. There were no rabbits in this burrow.

No. 3.—A small burrow similar to No. 2. 15 x 18 feet; 15 oz. put in at 10.30 a.m. Dug out 3.30 p.m. Diffusion of gas as in No. 2. No rabbits.

No. 4.—Burrow similar to No. 3, 15 x 15 feet; 15 oz. put in at 10.45 a.m. Opened up 3 p.m. One rabbit found alive 3 feet below ground and about 5 feet from nearest opening. Gas fairly well diffused.

No. 5.—Burrow same as No. 4; 24 x 24 feet; 24 oz. cyanide put in at 11 a.m.; dug out 4 p.m. No rabbits.

These experiments showed that the gas did diffuse to some extent at least, but suggested that possibly the burrows were not left closed for a sufficient length of time.

The toxicity of the gas given off by the calcium cyanide was demonstrated on one of the living rabbits caught. Its head was placed in the tin containing the cyanide, and it died in less than five seconds.

Second Series.

No. 6.—A small burrow on a river flat; 9 oz. cyanide put in at 10.30 a.m.; opened at 2 p.m. Result nil.

No. 7.—A burrow beside a creek, fairly large, and with many openings; soil slightly moist; 15 oz. cyanide put in at 10.45 a.m.; opened up at 3 p.m. Twelve dead and four living rabbits were obtained from this burrow.

The dead rabbits had evidently been destroyed by the gas, as they were only just dead and showed no evidence of any disease. No poisoning had been carried out recently. This burrow, besides being moist, was on a slight rise,

both factors which might have had an influence on the result. A little horse-dung was burnt in one of the openings and smoke driven through to indicate whether any leakage was occurring.

Third Series.

No. 8.—Superficial area 27 x 18 feet; in dry country on hillside; 12 oz. cyanide introduced at 11.30 a.m. 5th March. Dug out partly at 5 p.m., 5th March, and finished 9 a.m., 6th March. Three dead rabbits found. Gas evident on both days.

No. 9.—Superficial area 12 x 12 paces; dry on top, a little moisture below; on hillside in decomposing granite soils; 9 oz. cyanide put in at noon, 5th March. Dug out 10 a.m., 6th March. Four dead rabbits.

No. 10.—A burrow with one opening only; on edge of river flat; ground dry and hard; 6 oz. cyanide put in at 12.10 p.m., 5th March. Dug out 11 a.m., 6th March. Five dead and one living rabbit found. The living rabbit was 23 feet from the opening. The sexes of the rabbits were three male and three female.

No. 11.—A big sandy warren on river flat; superficial area 42 x 24 feet. Two gallons of water were used to moisten the openings of burrows to hasten evolution of gas. Cyanide (27 oz.) put in at 2.30 and 3 p.m., 5th March. Dug out from 12 noon to 5.45 p.m., 6th March, and finished on 7th March. Twenty-four dead rabbits and one living one were found. The ground was very dry and the gas still evident on completion of the work at 12.30 on 7th March.

No. 12.—A single opening burrow on hillside; dry. One gallon water used to provide moisture. Cyanide (5 oz.) put in 3.40 p.m., 5th March. Opened up 7th March at 2 p.m. Three dead rabbits found.

No. 13.—An old burrow on hillside; very dry. Three gallons of water used and 9 oz. cyanide. Put in 4.15 p.m., 5th March, and dug out 8th March. Four dead rabbits found.

Fourth Series.

No. 14.—Burrow on hillside; a reddish clay soil; very dry; 7 oz. cyanide placed in burrow at 12.20 p.m., 16th April, and dug out 18th April, eight rabbits obtained, five dead and three living. The presence of gas was not marked to the sense of smell.

No. 15.—Similar to No. 14; 3 oz. cyanide placed in burrow at 12.40 p.m., 16th April. Dug out 2 p.m., 18th April. Four rabbits, all dead.

No. 16.—Similar to No. 14, but very extensive; 14 oz. cyanide put in at 1 p.m., 16th April. Dug out 20th April. One rabbit dead. Work not completed.

No. 17.—Cyanide (3 oz.) put in 2.30 p.m., 16th April.

No. 18.—Large burrow, 30 oz. used.

No. 19.—Small burrow on flat, 3 oz. used.

No. 20.—Single opening burrow on flat.

Owing to lack of time, burrows Nos. 17, 18, 19, and 20 were not dug out, but four days after the cyanide had been put in they still remained unopened, so that the death of the rabbits in them is very probable. All were active burrows.

The material used in this series of experiments was from a tin that had been opened up some weeks, and the gas in the burrows was not so noticeable as in the previous three series.

As regards some of the living rabbits found, it is not considered that they could have survived, since they were at dead-ends with the gas-producing material and dead rabbits between them and any available opening. It is considered that the cause of death in all instances was the inhalation of hydrocyanic acid gas, there being no evidence or suspicion of any other cause operating.

In only two instances were the burrows entered from without after treatment and in no case were they opened up from inside.

Conclusions.

These results are considered encouraging and make further trials desirable. The advantages of this method of rabbit destruction are:—

(1) Only a small amount of labour is required.

(2) Providing the material is used as directed, there is absolute freedom from danger to live stock.

(3) As the burrows in which the rabbits are killed are closed up, blow-flies cannot breed in them.

(4) No expensive plant or machinery is required.

(5) There is no danger of destroying bird life.

(6) Poisoning can be carried out at any time and in any season.

The disadvantages are:—

(1) The rabbits, being left in the burrows, cannot be used as a commercial asset.

(2) The method cannot be relied on to eradicate rabbits.

(3) Wire netting would still be a necessity.

(4) The material used is very poisonous.

The actual destruction of the rabbits is due to the giving off of hydrocyanic acid gas by calcium cyanide. This gas is one of the most poisonous known and is rapidly fatal if inhaled in sufficient quantity. It is therefore necessary to issue a warning, which indeed is stressed by the manufacturers, that great care should be exercised that the tins containing the material are kept tightly shut when not in use, that they should not be kept in rooms used as sleeping and living rooms and that they should be put absolutely out of the reach of children.

The well founded objections to the use of potassium cyanide—that is, the danger to live stock, etc.—as a means of destroying rabbits do not apply to this material, so it would not be possible to use it in the same way.

It is proposed to carry the experiments further.

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Silver-leaved Nightshade (*Solanum elæagnifolium* Cav.)
(*Solanaceae*—Nightshade Family.)

Botanical name.—*Solanum*, Latin for nightshade; probably from *solor* to comfort; *elæagnifolium*, leaves like the *Elæagnus*, a group of ornamental shrubs.

Common names.—White horse nettle, Silver-leaved nightshade, Prickly nightshade, Bluetop, Trompillo, Bull nettle, Horse-weed.

Popular description.—A small shrubby, deep-rooted spreading plant with silvery-white leaves and stems, beset with sharp strong prickles. Leaves 1 to 4 inches long, covered with very small star-shaped hairs. Flowers blue or violet, 8 to 12 lines long, arranged in small clusters or single, on, or near the top of the branches. Fruit, a small round yellow berry, 4 to 6 lines in diameter, containing many small flatish seeds.

It somewhat resembles the Narrawa burr, a native species, but it is much taller with finer spines and smaller fruits; the leaves are also more silvery, not grey and rust-coloured underneath like the leaves of the Narrawa burr.

Botanical description:—Perennial undershrubs, densely and finely stellate-pubescent, silvery-canescent all over; stem branched, 1 to 3 feet high, armed with slender sharp prickles, or these sometimes wanting; leaves lanceolate, oblong or linear, petioled, 1 to 4 inches long, 3 to 12 lines broad, mostly obtuse, narrowed or rounded at the base, repand-dentate or entire; flowers usually cymose, 8 to 12 lines broad, violet or blue; peduncles short, appearing terminal but soon evidently lateral; calyx lobes lanceolate or linear-lanceolate, acute; anthers linear; ovary white-tomentose; berries globose, yellow, 4 to 6 lines in diameter.

Where found.—A native of North America, common on the prairies of Kansas to Texas and New Mexico, and a pest in cultivated lands and pastures generally. In 1823 it was introduced into England as an ornamental flowering plant.

Its appearance in New South Wales.—During the months of January and February of this year it was received for identification for the first time from Mr. J. M. Dixon, Koorawatha, and from Mr. L. J. A. Fitzpatrick, Warre Warral. It is not known when or how it was introduced into the State. Mr. Dixon, however, traces it from Cowra; he writes, "A little clump of less than a dozen plants are growing, and flowering in the middle of a four-acre paddock that was fallowed in the spring, and sown in December last with Sudan grass, the seed of which came from Cowra."

Nature of the plant.—In many parts of America it is a pest in pastures, along roadsides, and in cultivated crops. It is very hardy and propagates freely from seeds, and from rootstocks, which makes it all the more difficult to overcome. When cut off on a level with the ground it grows again; and when the roots are broken and scattered about by farm implements, many

Silver-leaved Nightshade (*Solanum elæagnifolium* Cav.

of them form new plants. Wherever the seeds are distributed they germinate and flourish, even under trying conditions. Mr. Dixson states that "it is a healthy and vigorous grower in spite of the prevailing dry weather, and judging from its prickly nature it has every appearance of being a trouble-some weed."

Uses.—According to Pammel, *Manual of Poisonous Plants,* page 724, "the berries are used to curdle milk in northern Mexico and southern Texas. They are crushed into a powder, put into a muslin bag suspended in the milk until coagulation occurs. It is also used as a medicine by the Mexicans."

Eradication.—Dig out deeply all isolated plants with spade or mattock. Medium-sized areas may be treated successfully with hot brine, kerosene, or caustic soda. One or two applications will be sufficient. Prevent seed production by cutting the weed before it flowers. It is well to bear in mind that the prevention of any top growth will eventually kill the plant.

Sustained Production Involves Rotation.

Greater attention has been paid to questions of farming policy in England, where the scope of country is limited, than has been the case in Australia, where virgin land is still plentiful. The rotation of crops is part of the farming policy of the landlords of England. Each lease contains a term that the tenant shall feed so many head of stock on the farm in order to place so much animal manure on the land, and thus keep up the fertility of the soil The justification for such a clause is that each tenant is thus made to leave the farm in the same state of fertility as he found it. If farming policy were not regulated in some way the tenant would naturally take all he could out of the soil without returning anything to it. If wheat happened to be a high price a tenant might in the last year of his lease sow the whole farm in wheat, reap and thresh the grain, and leave the farm in an impoverished condition for the next tenant to start on.

Conditions have been different in this respect in Australia owing to most of our farmers being owners of their own freeholds, and also because new areas have been generally available for development. These and other similarly favourable factors have not been, therefore, without their disadvantages in the effect they have had on farming policy, and Australian farmers must in the future adopt more of the scientific methods such as rotations, which have enabled the countries of the old world to produce good crops continuously on the same ground for centuries.—A. I. F. Education Service, Land Book No. 3.

What Seed Selection Means.

Seed selection consists of the continuous and repeated selection of a number of the best grains, ears, or plants. It is most effective when the individual plant is made the unit of selection, for it frequently happens that large grain and ears occur in relatively poor plants. Selection thus practised tends toward improvement of the type by propagating only from the best plants and excluding the rest.

Cowpeas for Green Manure.

On 12th December, 1922, a plot of deep sandy loam, 1½ acres, on this nursery was sown to black cowpeas, 38 lb. of seed being used (without manure) for the area. The rainfall from 1st December to 12th March (on which date ploughing under was begun) was 5·6 inches, of which 1·6 inches fell before the sowing.

Ploughing in Cowpeas at Narara Viticultural Nursery.

The growth was so abundant that a fair average section of the crop was weighed prior to ploughing under, and it was estimated that the crop ran 33 tons 12 cwt. per acre. Such a return from such a light rainfall is no doubt due to the favourable soil conditions.—H. G. White, Superintendent, Narara Viticultural Nursery.

Crop Prices in Relation to Plant-food Value.

To follow the correct farming policy, it is advisable that the farmer should know the relation between the price received for his crop and the amount of plant-food contained in it.

The amount of fertility lost to the farm by the sale of different crops varies greatly. The loss in grass (hay) and cereal crops is much greater than in vegetable and fruit crops. If a ton (2,000 lb.) of wheat, which contains 38 lb of nitrogen, 19 lb. of phosphoric acid, and 13 lb. of potash sells for 2s. 6d. per bushel, the nitrogen sells for 1s. 8½d. per lb., and the phosphoric acid and potash for 7d. per lb. If a ton (2,000 lb.) of milk which contains 12 lb. nitrogen, 4½ lb. potash, and 3½ lb. of phosphoric acid, is sold for £6, the nitrogen in it brings 8s. 4d. per lb., and the potash and phosphoric acid 3s. per lb. If, however, cream or butter is sold and skim milk fed to pigs and calves, most of the plant-food is recovered in the manure of these animals.—A. I. F. Education Service, Land Book No. 3.

Some Notes on Prickly Pear.

C. BROOKS, Inspector of Stock, Scone.

IN drought times, such as we have passed through in the past summer, the fact that prickly pear can be used as fodder for cattle cannot be lost sight of, for, notwithstanding that it is looked upon by most persons as a curse, and that analysis reveals that it contains very little food matter, many dairymen claim to have saved their cows in times of drought by feeding pear.

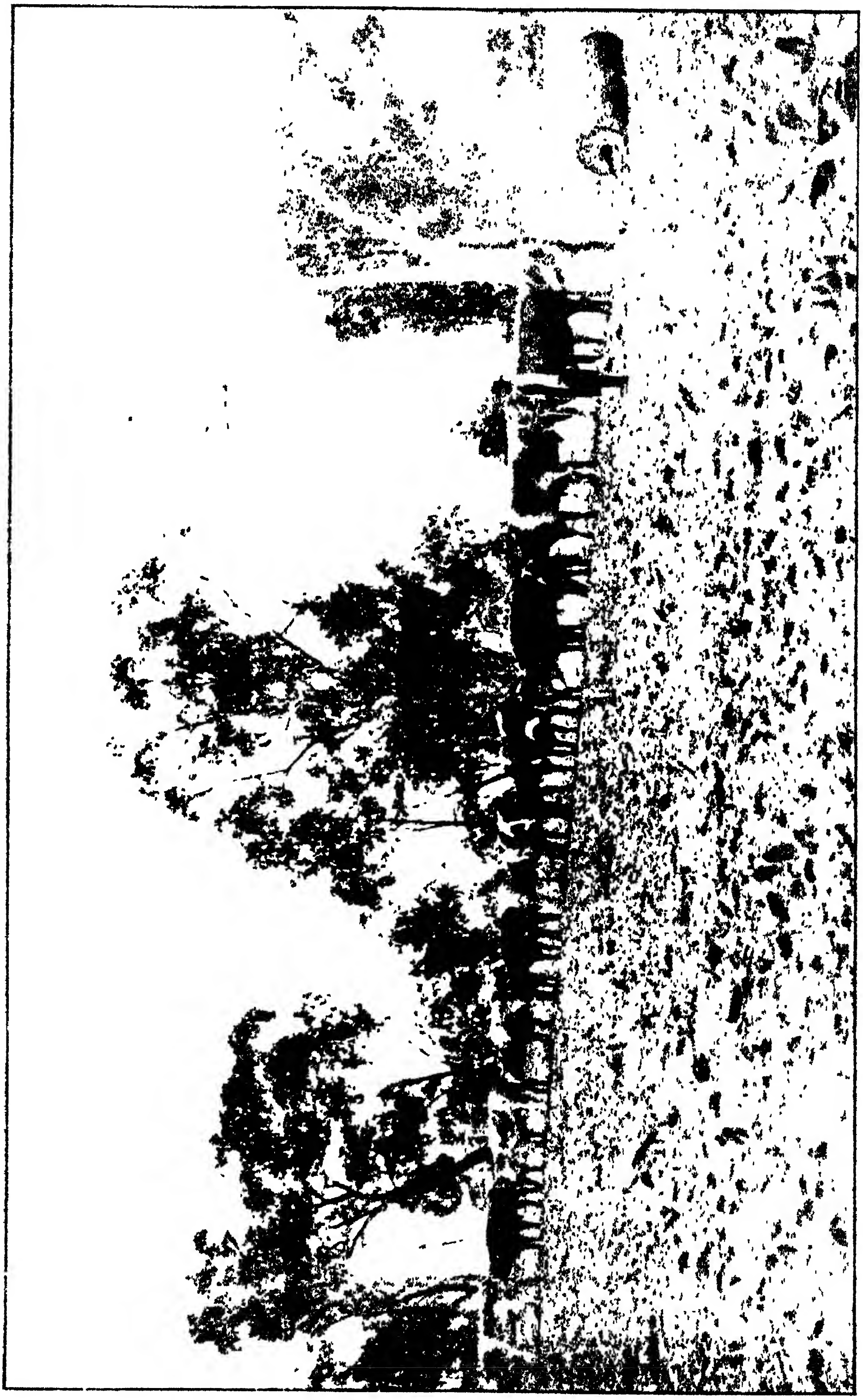
The usual means of preparing this fodder is to cut the pear in the bush, where wood is plentiful, scorch the thorns off there, cart it to the farm, and feed it to the cattle in open paddocks just as it is. Many farmers contend that the bulb and main stems of succulent pear contain the best feed matter, and such men discard the young, tender leaves.

Many other methods of preparing prickly pear have been tried, and one of the most practical is steaming. To do this an old, open-topped tank is procured, and so arranged that a fire can be lighted under it. In the bottom of the tank a few bricks are placed, and on top of the bricks some old sheet-iron. The tank is then filled with water to the level of the sheet-iron, the pear is placed on top of the sheet-iron, and the top of the tank is covered over with an old sheet of iron, boards, bags, or any other material handy. The fire is lighted under the tank and the pear is left to steam. Boiling has also been tried, but unless mixed with more solid food, boiled pear—and to some extent steamed pear—is not such a good ration as roasted pear, being so slippery, slimy, and sloppy that the animal is not able properly to digest it or to subject it to the usual process of rumination.

Various Methods of Destroying Prickly Pear.

However, it is of more interest to most people to destroy prickly pear than to deal with it as an article of food for stock. Many methods of destruction are adopted. By far the most effective—if the most laborious and sometimes the most expensive—is the old-fashioned one of digging the plant out and burning it. This may cost anything from 1s. to £10 per acre, but pear has to be pretty bad if it cannot be dealt with for £4 or £5 per acre, which is about as much as can be spent on most land. When the job is done in the good old-fashioned way it is finished, but this cannot be said of any of the other methods.

In the last twenty odd years I have watched with interest many practical demonstrations of methods of poisoning pear, the killing agent invariably being arsenic. I have seen the arsenic used from a very weak solution to the strongest possible, and my experience is that, at all events in solution with water and used as a spray, the killing properties of arsenic do not increase in proportion to the amount of arsenic used. A solution of 1 lb. of arsenic



The Crusher at Work on Prickly Pear

to 15 gallons of water, used as a spray appears to be as effective as one many times stronger. All sprays are undoubtedly more effective if the pear is slashed or cut about before application of the poison. As a practical means of eradicating pear, however, I do not place much faith in sprays of arsenic and water. Arsenic when held in solution in such things as sulphuric acid is much more effective, though difficult to use.

The only spray which, in my experience, is an unquestionable success is arsenious chloride. This will kill if properly used, and at a cost well under most other methods, except perhaps crushing, which will be dealt with later on. The one objection to the arsenious chloride spray is the difficulty of getting hired men to work it, and its greatest success has been where the settler has used it himself. I know of one case where some 300 acres of heavy pear was successfully cleared with this spray for under £3 per acre. On steep, rough country, where the pear is not too old, good work can be done with an injector, a machine whereby a small quantity of poison is injected into the bulbs and several leaves of each plant. For this, 12 lb. of arsenic, 6 lb. of soda, 3 lb. of sulphate of ammonia, and 5 gallons of water is a good, inexpensive mixture.

Before finishing with sprays and liquid poisons, I might mention an interesting method used on a property where wood was scarce. The pear was dug out and stacked on a small quantity of wood and sprayed with an arsenic solution, and after it had dried out the stack was burned, thus saving much wood.

Mechanical Means of Destruction.

Of the numerous mechanical means that have been used for dealing with pear, several are worth mentioning:—

1. A blast furnace was mounted on a wheel-barrow, and wheeled close to the clump of pear. The spines were then burned off and the pear left in better trim for stock to eat.

2. A naphtha-burning torch, worked under air pressure and carried knapsack fashion, was used to burn the spines off the pear, so that cattle could eat it. This was found useful in drought times The machine I saw came from America, but it does not seem to be on the market here.

3. A motor-car engine was mounted on a complicated machine, which it was purposed should move forward under its own power and pull the pear up, feeding it into a hopper, where it was minced up into small pieces about an inch square. The mincing-up process was perfect, and doubtless it would have killed the pear; but the machine failed to pull the clumps up.

4. In 1916, when there was much talk about the destruction of prickly pear with heavy gas, I arranged a demonstration at Aberdeen. The pastures protection boards were so keenly interested that £20 was voted towards the expenses, and a demonstration was given, but although the pear was affected the gas did not kill, and the process was, therefore, regarded as not worth further consideration.

5. Of all the mechanical schemes, "rolling" or "crushing" is the one most successful. It is usually called rolling, but it is more correctly crushing. A large roller is sometimes used to knock the pear down, so that the team of bullocks can get about the land. The killing is done by dragging over the pear a large log, fixed slightly at an angle, as many as twenty bullocks being used. The crusher does not 'roll' round at all, but passes over the pear with a sliding motion, the object being to crush and bruise the pear as much as possible; this a roller does not do. One crushing usually kills 60 per cent. of the pear, and the two subsequent crushings usually almost clear the land up. On suitable country the work can be done for about £3 per acre, perhaps less.

At times so-called diseases of pear come under notice. One recently submitted revealed the presence on the affected pear of *Macrosporium* and *Pleospora*, but whether these fungi were the cause of the diseased condition, or whether they were simply attacking decaying areas of the pear leaves was not clear. It would seem that there is scope for any amount of work along these lines.

The Texan Cochineal Mealy Bug is being tried out at Scone now.

"An Elementary Text-book of Australian Forest Botany."

The New South Wales Forestry Commissioners have issued Volume I of "An Elementary Text-book of Australian Forest Botany," prepared by Mr. C. T. White, F.L.S., Government Botanist of Queensland. It is the same size as the *Agricultural Gazette*, has 223 pages and numerous illustrations. It is divided into three parts:—

1. Morphology—The root; stem; leaf; inflorescence; flower; fruit and seed; general.
2. Anatomy—Cells; tissues and tissue systems; anatomy and development of plant members.
3. Physiology—General; osmosis, absorption and transpiration; chemical composition and food of plants; metabolism; growth; reproduction.

The only Australian work which covers some of the ground of the present one is "Outlines of Botany, with special reference to Local Floras," which forms the introduction to Bentham's "Flora Australiensis," but Mr. White's work goes much further than this.

While a work of this kind is necessarily general in its character, one charm of Mr. White's book is that he has referred to Australian plants wherever he could, and has given many illustrations (a large proportion of them original) of Australian plants. The work also is of a very condensed character, which adds much to the author's task.

A book like this will set people inquiring and accumulating additional information in regard to our plants, which is a great deal for any book to achieve. It may be looked upon as a companion to "Botany for Australian Students" by the Misses Brewster and Leplastrier, and will be appreciated by students of plants other than those of trees.—J. H. Maiden.

Agricultural Education and the Farmer.*

E. A. SOUTHEE, Principal, Hawkesbury Agricultural College.

EDUCATION—of whatever kind—has always been looked upon as a national and non-political responsibility. It is therefore fitting that an agricultural organisation such as the Agricultural Bureau (which is above all non-political) should interest itself in agricultural education. That being so, it might seem out of place or superfluous to discuss agricultural education in such a conference as this; but if we ask ourselves the question, "What is the farmer's attitude towards agricultural education and our agricultural college?" an analysis of the situation might show that there is a need—and a very great need, too—for discussing the question.

The chief functions of education are to increase (*a*) knowledge, (*b*) power, ability and skill to enable one to obtain an honest living by honest means, (*c*) goodwill in the individual and in the community.

Education is the training which fits us for life, teaching not only how to make a living, but also what is equally important—how to live, to make life worth living.

These functions of "education" are no less the responsibilities of agricultural education.

The age-worn adage "Knowledge is power" applies to agriculture as much as to any other profession; and since youth is the time to acquire knowledge, every advantage should be taken of whatever training, be it agricultural college or some other form, that is available.

To a large extent the agricultural education of the farmer's son has been traditional or patriarchal, the farmer being content to teach his son the methods which he has found useful and satisfactory, and which his father before him had used. Too often this teaching is limited to the farmer's own experience, and not supplemented by reading. To the farmer experience is undoubtedly an invaluable asset, but agricultural practice, like everything else, changes with changing times, and experience is robbed of half its value unless supplemented by the knowledge of the changes, reforms, advances and additions which have taken place.

In New South Wales the dissemination of knowledge on these points has been the particular responsibility of the Department of Agriculture and its experiment farms and Hawkesbury Agricultural College. It is some thirty-three years since the Department of Agriculture was formed, and very wisely, concurrently with the Department, an agricultural college was established, and in that time farmers have had sufficient opportunity to become acquainted

* Paper read at the conference of western branches of the Agricultural Bureau held at Parkes on 11th, 12th, and 13th April, 1923.

with the object and aims of those institutions. The Department of Agriculture, as such, has for its main object the collection, by experiment and otherwise, and distribution among farmers by means of correspondence, pamphlets, demonstrations and lectures, of useful information upon wheat-growing, live stock, dairying, orcharding, viticulture, irrigation, sheep breeding, pig-raising, poultry-breeding, plant-breeding, plant-diseases, and so on For this purpose use is made of the experiment farms, the College, and the various Departmental experts, scientific officers, and instructors. One doubts whether the farmer is making all the use he might of this source of information. However, one looks to the Agricultural Bureau to grasp the opportunity to become the great connecting link between the Department and the individual farmer.

That the farmer has felt the influence of the Departmental teachings and recommendations is exemplified in the improvement of methods of cultivation, *e g.*, fallowing, and in the introduction of varieties suitable for the varying climatic conditions of the different districts of the State, also the revolution in factory methods by the introduction of pasteurisation of cream.

What is the farmer's attitude towards our Agricultural College? Perhaps the College admission figures will give some idea of the situation. From the records taken over a considerable number of years one learns that of the total number of students enrolling, some 15 per cent. are sons of farmers and graziers, while the total number of entrants from country districts amounts to approximately 33 per cent.

The farmer is too apt to dismiss the College as a kind of glorified school, a theoretical institution where nothing useful is taught. He is too prone to accept an idea prevalent concerning all education—*i.e.*, that it is an end instead of merely a means to an end.

The proof of the pudding is in the eating, so we ask judgment of the College to be made on the product of the College, and more particularly on the graduate who has gone through the full course at the College.

The records of the Old Boys' Union show that out of the 2,840 students who have passed through the College, about 75 per cent. are definitely known (the proportion is probably 80 per cent.) to be on the land or engaged in agricultural instruction work. Ex-students of the College are successful farmers in various parts of the State and taking active interest and intelligent lead in the Agricultural Bureau of the State, others occupy departmental positions as instructors in agriculture and dairying, not only in New South Wales, but in other parts of Australia, New Zealand, and other countries. Students from our dairying classes have competed in open contests with representatives of dairy factories, and have more than held their own. As a consequence, the directors and managers of factories are now convinced of the value of the instruction given and the services of College graduates are immediately availed of. Our graduates include in Australia a Minister for Agriculture, an Under Secretary for Agriculture, and Chief of the Field Staff.

Although the greater portion of the College work consists in teaching the youth, there is a welcome for everyone—old and young. The object at Hawkesbury Agricultural College is " to teach the science of agriculture and the various sciences connected therewith and their practical application "; to train the hand and mind of men with a view to their adoption of farming in one of its branches or grazing as an occupation, or to enter the factory side of dairying. A farm of some 3,400 acres, with separate sections for dairy-farm and factory, stud piggery, poultry farm, orchard, apiary, sheep yards and shearing shed, as well as laboratories, are comprised in the College property. The instructional work covers Diploma Courses in Agriculture (3 years) and Dairying (2 years), Short Courses, designed to meet the needs of older men unable to take the full course, who desire to gain information in some special branch, *e.g.*, orchard (12 months' course), piggery, poultry, and dairy (6 months' course), Winter School for farmers and poultry-farmers, and Summer School in Apiculture.

Particular attention is drawn to the Winter School for farmers, which is held in the slack period of farm work for one month during June-July.

Another function of the College is to carry out experimental work with respect to crops and live stock, to test out new introductions of grasses and fodders, and to distribute them to farmers.

So far we have dealt with one particular aspect of agricultural education, but our Agricultural College and the Department of Agriculture have no monopoly with respect to agricultural education. Every farmers' organisation—be it Farmers' and Settlers' Association, Primary Producers' Union, agricultural society, or similar body, but most of all your Agricultural Bureau—and every farmers' paper and the rural press are directly and vitally concerned in the distribution of knowledge on agricultural matters. In other parts of the world farmers' organisations have been developed to a greater extent than here. Taking the case of America, we find in recent years a great development in agricultural co-operation, leading to the formation of organisations interested primarily in a particular section of agriculture—dairying, fruit-growing, and so on. While these are formed in the main for business reasons, they also interest themselves in community and educational matters. Other organisations are not so restricted in their scope, and embrace the general body of farmers. Generally speaking, they have been originally formed as farmers' movements with educational, political, and social aims; at the same time there has generally crept in the business element. There have been numerous organisations of this type, and many have failed to maintain their existence. The chief remaining ones now are The Grange, Farmers' Union, Non-Partisan League, and most important of all, the Farm Bureau Federation.

The first of these—The Grange—was planned to bring farmers together after their disorganised state, arising out of the American Civil War by creating among them a feeling of fellowship and comradeship. The Grange

was a secret order, with a well-thought-out ritual, designed to provide for the social and educational needs of the community. However, it was not long before co-operative buying and selling and other business activities were attempted. Although The Grange adhered very closely to its policy of taking no part in partisan politics—it did not form a definite third party—it did play a large part in seeing that the old parties included representatives with sympathetic feeling towards The Grange. By this means The Grange was able to obtain a good many favours from the legislature.

The Farmers' Union has been in existence for some thirty years. Marketing, better prices, and fraternal considerations were its aims. The Union attempted (1) to fix prices, (2) to limit production, but both were failures By encouragement of co-operation and building of warehouses, chiefly for the storing of cotton, the Union has built up a remarkable business, including grading, sampling, selling of the cotton, and establishment of farm credit organisations to finance the grower.

The Non-Partisan League is a recent organisation of a political nature. Not forming a separate party, it throws in its lot with and obtains representation in whichever of the two political parties of the United States will cater best for its needs. The main issue with which the League concerns itself is marketing It proclaims itself straight out for:—

1. State ownership of terminal elevators, flour mills, packing houses and cold storage plants.
2. State inspections of grain and grain dockage.
3. Exemption of farm implements from taxation.
4. State hail insurance on the acreage tax basis.
5. Rural credit banks operated at cost.

The League advocates straight out state ownership as opposed to voluntary co-operation

The great nation-wide farmers' organisation of the United States of America is the American Farm Bureau Federation.

The strong development of what is known as agricultural extension work in America was made possible by Federal and State laws, which allotted definite annual sums *pro rata* on a population basis to carry on this important work. Out of this there resulted the employment of county agents. The extent to which this has developed can be readily imagined when we read that the 3,055 counties of the United States employ 3,283 extension agents. There are some counties without agents, and others have two.

It might be profitable to discuss briefly the rôle of the county agent and his relation to the community. A county agent is the farmer's adviser—his duties include counsel and advice on all matters pertaining to agriculture. The systems of employment and the financing thereof vary in detail, but as a general rule he is employed jointly by the Federal Government, the State Government, and the counties, a county Farm Bureau being formed to control and direct the county agent and to administer the funds.

A county Farm Bureau is officially defined as "an association of people interested in rural affairs, which has for its object the development in a county of the most profitable and permanent system of agriculture, the establishment of community ideals, and the furtherance of the well-being, prosperity, and happiness of the rural people, through co-operation with local, State, and national agencies in the development of a program of extension work in agriculture and home economics."

It is non-political, non-sectarian, and non-secret, aiming not to compete with other organisations, but to co-ordinate in their work.

Its method of working runs generally somewhat as follows:—A programme of work is formulated by members, based on a careful study of the agricultural and home problems of the county; this programme is divided into what are known as projects, and "project leaders" are selected to develop some particular part of the programme, and are given the responsibility of finding ways and means for doing so. Although members of the farm bureau are responsible for the development of the programme, the county agent naturally must play an important part in an advisory capacity. The programme of work is commonly submitted to the State College of Agriculture and Federal Extension Services, which always co-operate and assist in carrying out the projects outlined—in fact, they are really in the position of partners with the county farm bureau.

The average cost of a county Farm Bureau has been estimated at about 4,000 dollars, the funds being contributed as follows:—Federal (U.S. Government), 26 per cent.; State appropriations, 18 per cent.; county, 56 per cent. The county raises about two-thirds of this money by county taxes and about one-fifth from membership fees, usually one dollar.

Arising out of the county Farm Bureau it was only natural to expect a State Federation. This was duly established, and was followed by the formation, in 1919, of the national organisation—the American Farm Bureau Federation.

The purposes of the Federation as outlined in its constitution, embrace education, business, and legislation. The business side seems to be the paramount issue—the Federation has become very actively interested in marketing problems, and is proceeding to develop the co-operative plans in which the commodity forms the basis of grouping. It would appear that the educational functions will remain the responsibility of the unit organisation—the county Farm Bureau. The problem now facing the Federation is that of its relation to politics. The experience of other farmers' organisations appears to demonstrate that their decline inevitably follows active participation in politics, but the trouble always is: how to avoid politics. So far the Farm Bureau Federation has contented itself by keeping a representative at Washington, to inquire into the political situation affecting the farmer, and to see that the interests of the farmer while Congress is in session are kept before that body.

I have briefly outlined the status of these different types of farmers' organisations because they have a distinct bearing on agricultural education.

The Agricultural Bureau movement in this State is going to play a big part in agricultural education.

The College and the Agricultural Bureau must always work close together. The College, as a discoverer and disseminator of knowledge, should send out men who are to be leaders of agricultural thought and take a keen interest in the Bureau, besides putting into practice the facts and theories which they have learnt at the College. The Bureau, on the other hand, must help to create a desire for better methods in agriculture, and for higher agricultural education. Why not follow the lead of the Northern Agricultural Association of this State by providing a scholarship to send a local youth to Hawkesbury Agricultural College? When one travels abroad, and hears of the rich endowments provided by public-spirited men for agricultural colleges, and agricultural research, one is grieved to find the absolute lack of anything of the kind with respect to our institutions. The land has often enough provided success in life and wealth for individuals without any recognition of the source of that wealth. The work of William J. Farrer, little recognised during his life-time, was no more appreciated after his death, if one can judge by the support given to the proposal to found a memorial in recognition of his great services, not only to the wheat-grower, but to the nation. In the development of this young Australia we are told that "Agriculture is the basis of the nation's prosperity." We have our problems peculiar to our own country, peculiar to each particular farm, all requiring the intelligent application of whatever knowledge be available. Let us see to it that our Agricultural Bureau is going to be the dispeller of prejudice and the fosterer of progress by taking up the rôle of missionary for the fuller development of agricultural education in all its phases.

We have passed the time for unintelligent farming—luck is a thing of the past. Too often in the past there has been the idea that if a boy was no good for anything else he should be sent to an agricultural college to be made a farmer, but it has to be recognised that farming requires trained intelligence just as much as any other profession. If a farmer wishes to have his son become a doctor he sees that it is necessary to provide a particular education; and surely the same situation must apply to agriculture

WHERE FUTURE IMPROVEMENT LIES.

THE farmer should keep himself in touch with all developments and inventions in labour-saving machinery. While avoiding any tendency to take up new things without due enquiry, he should always keep an open mind and beware of prejudice against new things just because they are new. Such a high standard has already been reached in labour-saving machinery for harvesting and cultivation that the advances of the future will probably take place chiefly in the handling and transportation of produce.

Dairying on the South Coast.

Better Methods are Becoming Necessary.

C. G. F. GRANT, Manager, Berry Experiment Farm.

For many years dairying on the South Coast has been credited with a measure of immunity from many of the troubles that beset the industry in other parts of the State. The excellent quality of the pastures and the assurance of a well-distributed rainfall have created a sense of security about the business that settlers in other districts would fain enjoy. But there is change in the air. It is within the mark to say that many successful South Coasters are becoming conscious that the margin between success and failure is much narrower to-day than in the past, and progressive men—old and young, old residents and newcomers—are realising that methods must be adopted in the future that were unnecessary in years gone by.

These changes are being imposed by various circumstances. Many attribute them to the fact that the seasons seem to be getting drier and more erratic, while others are of the opinion that the sterner commercial conditions and keener competition of the day are beginning to affect the primary producer in a way hitherto unknown. Whatever the quarter from which the pressure is coming, it is becoming apparent that the successful dairy-farmer of the future will manage his pastures with a care unthought of at one time—will conserve fodder regularly, will ensure a supply of green feed in the months of the year when the natural pastures are scarce, will select his cattle with greater care in relation to their production, and will see to it that his young stock are better producers than their dams.

Pasture Improvement.

In this extensive programme—of which every article is of commercial importance—the improvement of the pastures is the first item. It savours, perhaps, of a negative step, but it is a very essential one. Many valuable pastures on the coast show evidences of neglect, and could be made to produce larger quantities of good feed at little outlay. The removal of logs, of tussocks, and of the "cutty grass" that is so commonly seen, is by the way. But there are changes of wider application that must come. The paspalum paddocks require better management on many farms. Whether the intrusion of this grass has been a good thing or not, it is here to stay, and farmers have the experience of the North Coast to guide them in their use of it to best advantage. Subdivision of pastures to enable the paddocks to be grazed in rotation, is necessary in some parts, and everywhere the paspalum requires to be handled so as to prevent it becoming coarse and tussocky. A good deal can be done in this direction to ensure finer and better swards. Use hould be made of the mower to this end—not that continuous mowing of a

paddock is suggested; that would not be satisfactory. But if a paspalum paddock is mown one year and eaten down the next, the grass will be improved, and the clover—such a valuable feature of these pastures and so necessary to ensure a better ration in the late autumn and spring—will be preserved. It will pay not to mow paddocks that are to be used as night paddocks for the winter, as the long rank grass of the summer and autumn makes good bedding. Such paddocks should be sheltered against south-westerly and westerly winds, if not already protected; the day is coming when, as part of the policy of improvement, breakwinds will be planted.

From the paspalum cut in the latter part of the summer, as suggested above, either hay or ensilage can be made. It is somewhat rough fodder, perhaps, but if mowing takes place before the grass becomes harsh it will be found to provide very useful feed for the dry stock in the following winter or spring.

The Growing of Fodder Crops.

The next thing the South Coaster must do is to study the climatic conditions of his district, and know when fodder is most needed. In the Berry district, for instance, and over a considerably larger area, the greatest scarcity is from July to November or December. The pastures usually begin to improve in October, but provision should be made to continue hand-feeding until Christmas, as, indeed, was necessary in the season just passed Moreover, in the summer and autumn it is often possible to help the milk yield by feeding succulent greenstuff, so that there is hardly a season of the year for which the farmer should not be ready. No doubt the prospect seems a formidable one, but it is no more than the facts are beginning to indicate as necessary if maximum profits are to be made.

The value of feeding greenstuff in winter is already realised by many, but the practice will have to be developed. It is valuable, not only to maintain, in a measure, the milk flow in winter, but to prevent the scouring that frequently follows the first spring flush of grass where the cattle are only on pasture. Winter feeding, too, keeps the cows in such condition that they respond readily at the bucket when the grass comes away in the spring. If, on the other hand, they are low and poor when the grass shoots, a good deal of feed (as well as time) is required to build up the animals before the milk yield can improve. "They put it on their backs first," has become proverbial, but it is almost equally proverbial that the farmer has not hitherto anticipated the facts by feeding so as to prevent the cows ever getting so low. Again, cows allowed to become low in the autumn and milked in the winter do not test as well as if they meet the cold weather in good condition.

Dry stock also require a little special attention. Progressive men are realising that the dry cows give a handsome return for extra feeding and that the young stock require to be well treated if they are to turn out profitable animals. There is an old Scotch saying (well supported by experience), "If

you don't put it into the calf, you won't take it out of the cow." The paspalum hay and silage already referred to are suitable for this purpose, and will return handsomely all the labour put into harvesting and feeding it.

All this, of course, demands that crops shall be grown on the farm, and that, not in a casual or haphazard fashion, but systematically and regularly. The dairy-farmer of the future will study the crops and varieties suitable for his district, will adopt a regular system of farming, and will practice rotation in a husband-like way. Nor is there any need for alarm at the suggestion. The result is going to be greater profits, and probably from a smaller number of cows, though these, withal, will be better selected, better handled, and better fed.

The various crops and their times of sowing, the manner in which various farm operations follow one another so that there is no necessity for "rush" at any time, and the periods at which the different fodders are fed out, may be set out in a tabular form, thus :—

CROPPING, HARVESTING, AND FEEDING PROGRAMME.

October-November ...	Sow maize for grain.
October-December ...	Sow maize for silage or broadcast feed.
November-December ...	Sow sorghum and Saccaline.
January-March	Make ensilage from maize and paspalum; make hay from paspalum.
March-April	Sow barley and field peas for hay and green feed.
April-July	Sow oats for hay.
May-July	Feed green maize and Saccaline.
June	Graze off rank growth on hay crops if necessary.
July-September	Feed green barley and green lucerne.
August-October	Feed maize silage; feed dry stock on paspalum silage (though silage will, of course, be fed at any time when green feed is scarce).
September-November ...	Make oaten hay; also lucerne hay where this crop can be grown.

The distribution of work throughout the year is the self-apparent recommendation of this programme. At no season is there any great pressure of work, but in every month something is going on, so that labour is evenly distributed over the whole year. It should be an axiom of the system that nothing shall be purchased that can be produced on the farm. Even the grain ration, so largely bought from the merchant, should be home grown—the more so because there are so many valuable varieties that will grow well on the coast. Maize is pre-eminent, of course, and Fitzroy can be mentioned as one variety particularly suited to the district for dual purpose.

The operation of harvesting the maize should be made as inexpensive as possible. Owing to maize maturing on the coast at a period when wet spells are frequent, it is good practise for the farmer who is growing for home use to husk the cobs in the field. This allows the grain to dry more quickly, saves handling in the barn, and makes it possible to crush the cob and the grain in the one operation with a cob and grain crusher, and to crush such quantities as are required from time to time. The crushed material can be fed out as concentrate in combination with any of the other fodders, and gives excellent results.

For the earlier varieties of maize for silage, &c., Hickory King, Boone County White, or Leaming, or for late green feed, Fitzroy, Golden King, and Pride of Hawkesbury are useful sorts for local conditions. They will come forward in succession, and thus enable harvesting to be effected without pressure, and each variety to be cut when at its best. The broadcast maize should be chaffed and fed out in Febuary and March in the paddocks. Feeding out the crop whole is wasteful, but by the use of the chaffcutter all the material is fed, and all the animals, young and old, get their proper ration. It is important to the whole rotation that the maize be got in early and in clean ground.

There is no fixed period of the year during which silage should be fed. It is conserved to be used immediately the supply of green feed gives out, and it should be fed in combination with oaten chaff and crushed maize, or some other concentrate.

The programme suggested above permits a good deal of the land carrying summer crops to be cleared in the autumn and sown with the green food and hay crops for the winter and spring. The field peas associated with the barley will help to renovate the soil in view of the next crop.

What Co-operation may do.

It is essential that in connection with all this the farmer shall go in for a wholesale reduction of costs. No trifling reductions will do. The above crop growing and feeding programmes, as carried out by some people, are apt to be much more expensive than they need be, and certainly more than in some other countries. One way of reducing costs is to introduce and establish co-operation on a considerable scale. The implements necessary to all that has been suggested in the way of cropping would involve a far greater sum than many farmers could afford, and even if the capital were available, the outlay would be too large to be strictly profitable. A double-furrow plough, for instance, can be made use of on two or three farms; the harvesting of maize and sorghum for ensilage should be effected with a corn harvester, which also is expensive—not less, perhaps, than £50—whereas half-a-dozen farmers clubbing together could make one such machine serve all. How essential it is to economical harvesting needs little insistence; with it one man can cut and bind 5 or 7 acres of maize per day a task that three or four men could hardly equal without it.

Substantial economies can be effected by co-operating in the erection of silos. For instance, the plant for the erection of the first is almost as expensive as all the other costs on two or three, while one plant will erect many silos. The purchase of one such plant on a co-operative basis by a number of farmers would reduce this cost to all, while such materials as the sand, cement, and timber could also be procured in large quantities at lower rates all round and lower freights. The equipment for the filling of the silo can be procured in the same way. The engine, chaffcutter and elevator, or silage-cutter, and the blower mean an outlay of approximately £200, but one plant would amply serve several farms.

On seed bought in large quantities savings can be made, both on the initial price and on the freight, while it is obvious that for a large line it is possible to ensure a better quality, and better graded class of seed The same applies to the fertilisers. Even on superphosphate economy can be effected on large lines, but most farmers on the coast use blood and bone, and the same applies to it. It is, perhaps, timely to remark that South Coast farmers would be wise if they used superphosphate more largely, on account of the quicker and better germination it ensures. The purchase of cow rugs on co-operative lines would considerably reduce the cost where it is found necessary to rug.

Herd Improvement.

It is obvious that another essential feature of better methods in this part of the State is the adoption of a system that will reveal the actual value to the farmer of each member of his herd. Good as many of the herds of the coast are, there is hardly one that does not contain a few poor producers, and there are far too many herds in which the proportion of such animals is an appreciable one. A regular method of recording the yield of each animal is sure to come, and with it the elimination of many wasters and an improvement in the standards of the herds.

Closely associated with this system is the improvement of the herds by the consistent use of bulls from known producing strains, and the abandonment of the old idea that there must be "a change of bull every three years." Breeding for production and type must instead become the rule. Nor is it necessary to such a change that every farmer purchase a high-class sire for his herd. Here, again, co-operation is possible with great advantage. In Denmark it is done by means of what are called "bull clubs," of which a brief account may be interesting.

Such a club is formed by, say, four farmers, who possess respectively, say, forty, sixty, eighty, and 100 cows, all of one breed, contributing to a common fund on a proportionate basis; they might, for instance, put in £10, £15, £20, and £25 respectively. With this £70 a bull of really good type can be procured—far superior to what anyone of the club could probably have afforded. From the four farmers the two best judges of the breed are selected, and they purchase a bull. Next they inspect the four herds, and determine exactly which cows in each herd shall be served by the bull, the number in each case being fixed, of course, by the amount of purchase money contributed. In order that the progeny of the bull may be preserved primarily for the benefit of the joint owners and for the improvement of their herds, it is usually agreed that if any member of the club wishes to sell any of the bull's stock, it must be offered to the members of the ring first.

The invariable result of such clubs is a general and steady improvement in the herds, and the poorest farmer in the country is able to participate in the use, perhaps, of the best bull in the countryside. Obviously the system affects several herds for good, and eliminates mongrel types of both

bulls and cows, while a distinct increase in competition in the show ring has been observed where several rings exist. These clubs insist that the members shall adopt individual testing, especially where (as is the case in some parts the club has been subsidised by the Government.

The foregoing suggestions do not exhaust the possibilities of improvement on the South Coast, or indicate all the directions in which we may look for advancement, but they may serve to bring into the arena a subject that is already engaging increasing interest.

Stypandra glauca—A Suspected Poison Plant.*

This plant is found on the coast, the Blue Mountains, and parts of the western slopes. It has frequently been reported as harmful to stock, especially during dry spells, and reports from Western Australia state definitely that the plant is poisonous, though stockowners in this State are divided in opinion about it. At various times the plant has been accused of causing blindness in forty-eight hours, partial paralysis of hind-quarters, death in twenty-four hours, and nervous irritability.

To gain definite knowledge concerning *S. glauca,* experiments were carried out by us, as officers of the Stock Branch, Department of Agriculture. The plant was identified by the Government Botanist, Mr. J. H. Maiden.

Short experiments were carried out in the Dubbo, Molong, and Sydney districts, and lengthy feeding ones at North Bangaroo Stud Farm, where the Manager, Mr. R. A. Patten, B.V.Sc., provided experimental animals and facilities for the work. The results may be summarised as follows:—

The plant was fed to animals of five species, viz., horses, cattle, sheep, guinea-pigs, and kangaroo. The number of individual animals experimented with was thirty-two, made up of four horses, two cows, one calf, twenty-two sheep, two guinea-pigs, and one kangaroo.

Experiments were carried out in five different months—January, May, June, September, and December—and were spread over three years.

The longest period over which animals were fed exclusively on *S. glauca* was twenty-five days. The largest quantity eaten in a short period was 14 lb., consumed in three days by a cow.

In no instance were any deleterious effects whatever observed.—Max Henry and W. L. Hindmarsh.

*Abstract of paper read before the Royal Society of New South Wales, 6th June, 19.3.

Experiments in Drying Whole Apricots.

Experiments in the drying of whole apricots at Yanco Experiment Farm last season demonstrated that the dipping of the fruit for three seconds in a solution consisting of 2 lb. caustic soda to 30 gallons water was productive of the best results. Dispensing with dipping resulted in a dull product of poor colour, while variations in the strength of the dip and of the period of dipping in each case proved less effective than those mentioned. In each treatment the fruit was sulphured for twelve hours, sulphur being used at the rate of 1 lb. per 300 cubic feet. These results are consistent with those obtained in experiments carried out during the previous season.

Pruning Young Deciduous Fruit Trees.

The Comparative Advantages of the Stopped and the Unstopped Leader.

W. le GAY BRERETON, Assistant Fruit Expert.

Within the last few years "long pruning," as advocated by Mr. Warren P. Tufts, of Berkley College, California, has attracted attention in this State. Judging by some of the statements that have appeared in the press, it is apparent that the Department's attitude towards the method, laid down by Mr. Tufts in Bulletin 313 of the Berkley College of Agriculture, entitled "Pruning Young Deciduous Fruit Trees," is not always understood; hence the reason for the present article.

In the first place it may be mentioned that the Department carried out long pruning, chiefly on apple and pear trees, prior to 1910, and it was on the results of this work that much of the revision of the Second Edition of the Department's book "Pruning," published in 1911, was based, and that the instruction given at the various field demonstrations of pruning was modified. That the Department is not averse to long pruning is shown by the following quotations, taken from "Orchard Notes" of *The Agricultural Gazette*:—June, 1916, issue—"The general tendency of the expert pruner is to carry on a system of comparatively light thinning out, rather than a heavy cutting back. The former is specially necessary on the better class of soil and also where irrigation is carried on. In the lighter, poorer soils of our coastal districts it is necessary in most cases to give a regular cutting back of the whole tree." May, 1917, issue,—"It has also been found that in very vigorous trees which have their shape well established, it is well only to thin out the leaders and not top them back for a season." July, 1917, issue—"but when the scaffolding branches or main framework of the tree is well established it is often best to cease topping the leaders and merely thin them out to the desired number." A similar note has appeared during the pruning season each year.

The Department, however, does differ from Mr. Tuft, in that he advocates non-topping while the lower part of the framework of the tree is being formed, whereas the Department delays non-topping till the lower part of the framework has been developed.

Cutting Back at Planting.

The practice of cutting back the young deciduous fruit tree when it is planted is generally advantageous. We have noted cases where a tree has made satisfactory growth during the first season after planting when it was not headed back at planting time, but, as a general rule, trees treated in this manner make a very poor start the first season compared with those

that are headed back when planted. It must be remembered that much of the root that has formed the top when the tree was growing in the nursery is lost when the tree is transplanted, and also that the part of the root that is retained has to become established in its new position before it can commence to function. It would, therefore, hardly be reasonable to expect this part of a disturbed root to support all the top that had been formed by a full root, and simultaneously to make satisfactory new growth. As this practice is very generally accepted it requires no further comment.

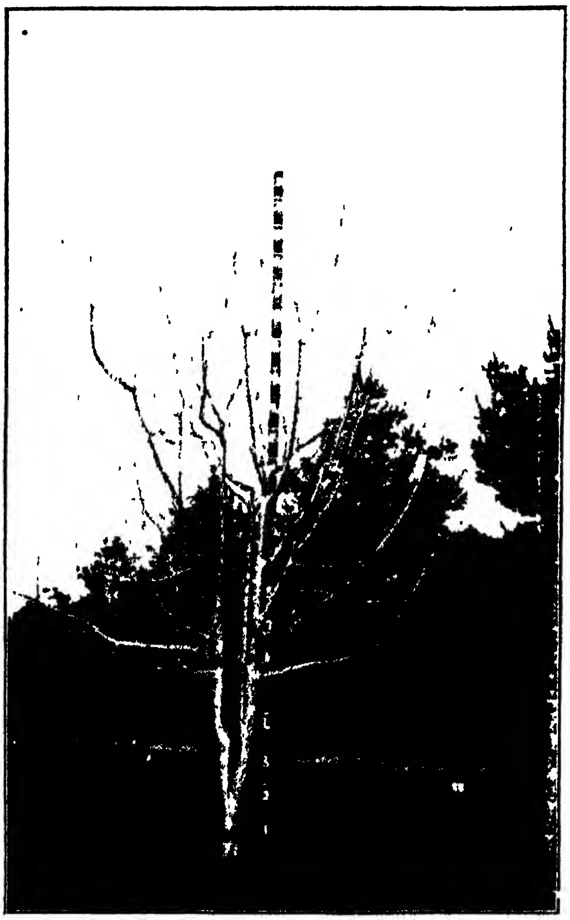


Fig. 1.—Winter Cole Pear, developed without topping.

Showing lack of spread and scarcity of main limbs at lower part of framework.

Top for Some Seasons After Planting.

After the tree has been in its permanent position for a full growing season, provided that it has experienced favorable growing conditions, the balance between the root and the top growth would probably be reached. If this be the case and the top is healthy, we can hardly expect increased growth by topping back. Why then do we continue to top back the young tree during the developing years of its life? One of the chief reasons is because most of our deciduous trees will not assume, unaided, a form or shape that is economical for the necessary operations pertaining to fruit culture, such as cultivation, spraying, and picking.

For instance, a tree one season after planting, will at best only possess two to five (and rarely the latter) serviceable leaders that can be retained for the building of the future framework of the tree. These in many cases (particularly in many varieties of apples, pears, and plums, such as Granny Smith, Williams, and Wickson) will assume a very upright position. If they are not topped back they will continue their extension in an upright position, and though eventually through cropping the top will assume a spread, the main limbs of the lower part of the framework will be

clustered together—in other words a narrow-gutted tree without sufficient space for the development of fruit-bearing laterals or spurs along these lower parts of the framework, will be formed. Moreover, many varieties will not naturally subdivide at the required places, so that a tree is developed which has too few main limbs.

After obtaining satisfactory results by leaving apple trees untopped when the lower part of their framework had been sufficiently developed, the Department carried out further tests to ascertain whether non-stopping could be practised at an earlier stage. Figures 1 and 2 show the results obtained by following such a practice with Winter Cole pears. The tree shown in Fig. 1 was planted in 1911; it was topped back at planting, and again the first winter after planting. It was then developed without topping, and pruning was confined to thinning out only. Though, when pruning preference was given to the more spreading shoots, the main limbs are close together. This is more clearly shown in the close up view of same tree (Fig. 2), which also shows the absence of any subdivision or multiplication of main limbs till the 4 feet 6 inch mark is reached This tree is fully 22 feet high at present, though it was considerably reduced in height in 1918.

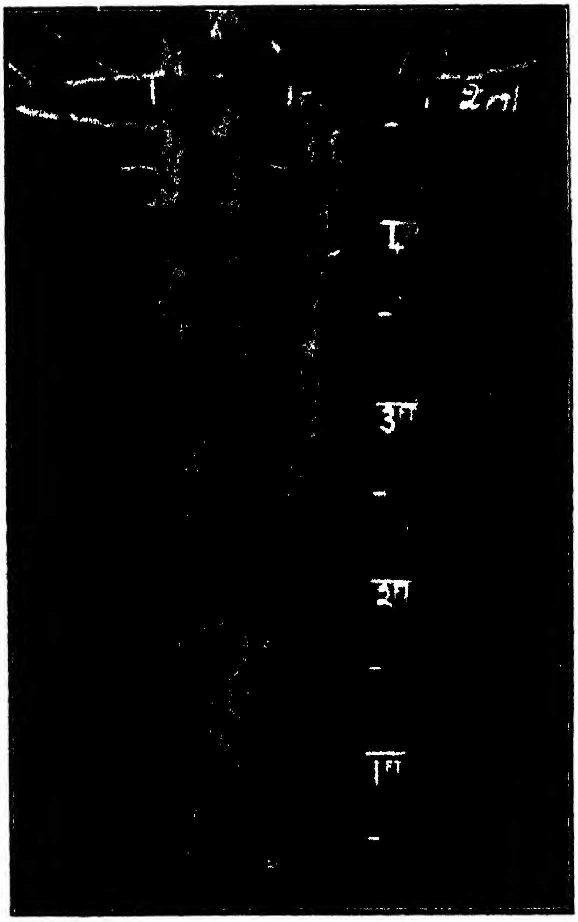


Fig. 2.—A closer view of lower portion of same tree.

Figures 3 and 4 show a Winter Cole tree that was annually topped till the lower part of the framework was developed. Now let us see what can be done by topping back such an upright grower. In the first place, by cutting back the previous season's growth during the dormant period, more buds are started into strong growth, and thus an ample supply of leaders is provided to form the future main limbs of the tree. By the checking of the upright leaders during the spring and early summer the growth is directed into the

more spreading leaders, which are chosen during the following winter pruning for the development and extension of the framework, when the checked upright ones are removed. It is often a practice in topping upright growers to cut to a bud above the outside bud, so as to encourage the growth from the outside bud to grow out at a wider angle. The growth from the top bud is checked during the spring and early summer, so that it will not sap the required leader below, but it is not removed till the following winter pruning.

Fig. 3.—Winter Cole Pear.

Note the spread of the lower part of the framework, obtained by topping during early development.

The result of topping back in the case of upright growers is twofold—increased spread of the tree, thereby making more room earlier or lower down for increase in main limbs, is obtained, and a greater number of strong shoots from which to increase the main limbs, are formed. It might be mentioned that topping is also necessary in the development of precocious croppers, to avoid too much sagging or serious breakage. This also applies to a greater degree to trees of a naturally spreading habit.

Figures 1, 2, 3, and 4 illustrate why continuation of topping until the framework of the lower part of an upright tree is advocated.

Topping the Naturally Spreading Tree.

Some trees—the Satsuma plum, for instance—will naturally spread too much, and though, perhaps, unaided by pruning, will assume such a shape that the fruit is yielded within easy reach of the picker, they will form a spreading head which is too low, and which will be costly in regard to cultivation. Such trees, when topped back while young, have this sagging habit corrected, and the topping also induces more buds to start into strong growth, and there is, consequently, a greater choice of more upright leaders. Thus a tree may be built with the lower part of the framework sufficiently compact to allow horse implements of cultivation close to the butt

Figure 5 shows a Satsuma plum growing in Mr. Watkins' orchard at Lower Portland, Hawkesbury River. This tree was topped for the first four years, and left untopped last winter pruning. Note the compactness of the lower part of framework, allowing for horse work close to the butt; also, that if there is any excessive sagging or breakages—as is not unlikely in this variety when not topped—it will be high up in the slender tops, that will not cause serious damage. Any orchardist familiar with this variety can imagine

Fig. 4.—A closer view of the lower portion of the same tree.

where the main limbs would have been if left untopped earlier. Figure 6 is a Wickson plum in the same orchard. This tree was also topped for the first four years and left untopped last winter. The Wickson is naturally as upright in its habit as the Satsuma is spreading, and the photograph shows how, by topping, the lower part of the framework has been developed with sufficient spread.

When Should Topping Cease?

This annual topping back should be continued till a suitable framework has been established. That topping back the main leaders undoubtedly delays trees from coming into crop in some cases is admitted, and also that, especially in deep soil in conjunction with other good growing conditions, annual topping produces many strong growths that are not required for building the framework of the tree, and which must be either removed during the growing period or during pruning in the following winter, if the tree is not to become too crowded in the head to the detriment of the fruiting members carried by the main limbs below. As previously stated, it is necessary with some varieties to limit the cropping in the early years to avoid breakages, or the formation of trees awkward to handle, and often the waste of a couple of seasons or more in reforming trees that have been broken down or pulled out by too heavy cropping. With other varieties, however, that are naturally slower to come into regular bearing, it is wise after a certain development is reached, to confine pruning to thinning only and to allow the leaders that are retained for the continuation of the framework to remain untopped for one or more seasons, especially when such trees are under favourable growing conditions. Such a practice not only induces earlier cropping in some cases, but also produces less superfluous strong growths and thus causes less work either during the growing period or at pruning in the following winter.

Fig. 5.—Satsuma Plum.

opped for the first four years, and left untopped in the winter of 1922. Note the compaction of the lower part of the framework.

The period at which the non-topping practice may start cannot be stated in terms of so many seasons after planting; it depends on the development

of the tree. In the first place, sufficient main limbs must have been attained, for when topping is discontinued there is no certainty of increase of main limbs by subdivision in desirable places. In the second place, the lower parts of the main limbs must be stout enough to stand the strain of the long tops, otherwise there is grave danger of serious breakages or excessive spreading, thereby wrecking the framework, if not permanently, at least to the extent of involving severe pruning, and postponing the date of the tree coming into full bearing; thus defeating the very object which was aimed at (see Figure 7).

Fig. 6.—Wickson Plum.

Topped for first four years, and left untopped in the winter of 1922. Note the spread of the lower part of the framework

Where peach trees are growing under good conditions, such as on light rich soil, in a warm, dry climate, with irrigation, the stage referred to may be reached at an early age, and if one anticipates high prices for peaches it is worth while risking a long pruning on very young, strong trees, for the peach crops on the previous year's growth and an immediate return will probably be obtained. Moreover, a young peach tree, even if pulled about by heavy cropping, will soon build up again after judicious pruning the following winter. At the Glen Innes Experiment Farm orchard, it was found that while peach trees (the trial included five different varieties) were still making strong growth, leaving the leaders untopped did encourage the renewal of fruiting laterals along the lower portions of the main limbs, but that after the trees had settled down into moderate growth, neither the topping or non-topping of the leader had any influence on the renewal of the fruiting laterals below.

The same results under irrigation and very different soil and climatic conditions were obtained at Yanco Experiment Farm orchard.

Notwithstanding these consistent results under very varying conditions, we have found some instances, at pruning demonstrations, where non-topping of the leaders has given anything but the desired result, not only with peaches, but also Japanese plums. Special cases may occur with certain varieties. For instance, it is very difficult to get the Williams pear to form fruit spurs along the main branches in our coastal districts, as it does in most of the tableland and inland districts. Under coastal conditions it chiefly crops from the terminal fruit buds or spurs near the end of the laterals, and the crop is chiefly obtained from a fringe over the outside of the tree. If it is decided to grow this pear in a coastal district the best plan appears to be to leave it untopped, in fact practically unpruned, at a very early stage of development. As a rule, there is no danger of it being badly "pulled out" from early cropping, but, on the other hand, if growing conditions are at all good, a tree very similar in shape to a poplar results, which is very difficult both to spray and to pick. In a recent number of the *Californian Cultivator*, a method of tying down, in place of pruning, was advocated. This method is worthy of trial on Williams grown in our coastal districts.

Fig. 7.—The result of leaving a precocious cropping tree untopped before the lower part of the main limbs are stout enough to stand the strain.

[*After Quinn*].

Some varieties may be safely left untopped at a very much earlier stage than others. For instance, Gravenstein (Carpenter), and Fameuse (Pomme de Niege, Snowy, or Fanny) apples are generally slow at coming into bearing, and there is thus very little danger of them being broken about by too early cropping; moreover, both these varieties naturally form plenty of strong shoots from which main limbs may be started.

It is advisable, in many places, to leave the cherry untopped as early as possible because of its habit of gumming; moreover, there is very little danger

of it cropping at a too-early stage. However, care should be taken that a sufficient number of main limbs has been developed before topping ceases.

From the foregoing it must not be concluded that the Department argues that topping of the year's growth renders the growth stouter, for we have had evidence from our tests that, in some instances at least, especially in apples and pears, this is not the case, and where apple trees have been left absolutely unpruned for several seasons after the fourth year from planting, not only were the trees, in most instances, bigger all round than their neighbours of the same variety on which pruning had been continued, but the main stem and limbs were also thicker.

But by topping the natural extension is reduced, as is the load at the extremity, particularly so in varieties of fruits that crop on the previous

Fig. 8.—Cleopatra Apple showing weeping habit, the result of being untopped for fourteen years.

year's growth ; in other words, there is less leverage. The more slender part of the extension is removed, leaving the thicker part nearer the base, and the extension is slower, giving the older parts time to thicken up.

Can Non-topping be Continued Indefinitely?

The number of seasons that non-topping should continue depends on the condition of the tree, which often depends largely on the conditions under which the tree is growing and the crops it has borne. In some cases the tree may be left only one season, in others two, three or more. If left untopped

indefinitely, in a great many cases the tops will gradually extend and sag over, and ultimately overshadow the lower part of the tree to such an extent as to put it out of cropping, as shown in Fig. 8. In some cases in strong, upright growers, especially if the tree has missed a crop or two from frosts or other causes, the tree will extend upwards to become a regular sky-scraper, and the upper portion will be very expensive to pick and spray, and it becomes necessary to reduce the top as a matter of economy. Thus, a certain amount of dwarfing by pruning in some cases, is not a drawback but an advantage.

With certain varieties, the Jonathan apple for instance, it is very risky to leave the main leader untopped for a long period (varying according to the conditions under which the trees are growing) as it soon slackens in vegetative growth if unstopped and the fruit becomes very small; if left in this condition long the tree is liable not to respond too well to cutting back into the old wood. With trees generally there is a decided danger in leaving them untopped for too long a period, as a very severe cutting back must then take place to re-form the tree. The tree may not respond too well, or on the other hand, a strong vegetative growth may be set up that will upset its cropping habit and entail a deal of subsequent pruning. When reducing the top that has been let run, it is of course necessary to cut back to two year-old or older wood, and where possible it is always preferable to cut back to a vigorous yearling side shoot. A more satisfactory growth generally follows cutting in such a manner.

At Berri Experiment Orchard, South Australia, where a test has been carried on for many years, heavier yields have been obtained from Royal apricots and Early Crawford peaches when pruned to the unstopped leader, but Moorpark apricot and Elberta peaches gave the highest yields from trees with the leader topped to definite buds.

A few years after the practice of non-topping was first introduced at Departmental pruning demonstrations we noticed instances of the system being carried out by growers on trees at too early a stage, and the bad results that ensued showed that great caution is necessary in advocating the system.

The Department still advocates non-topping under certain conditions, but only after the lower part of the framework is sufficiently developed. If carried out then, any excessive spreading takes place on the more slender tops, where it will not interfere with horse cultivation, and even if breakages do occur there they do not upset the main framework of the tree, and the damage can be corrected without resorting to drastic pruning. It is safer to err on the side of continuing topping for a season too long, than to give up topping a season too soon.

An Aspect of Vegetable Growing on the Coast.

A. J. PINN, Special Agricultural Instructor.

UNDER coastal conditions there should be little need for the purchase of costly artificial fertilisers. In view of the fact that large quantities of animal manure are available on dairy farms, it should be possible to utilise this valuable material to the full, and thus to reduce the quantities to be purchased of those fertilisers which supply nitrogen and potash and which are so expensive. Only of phosphoric acid, the addition of which in some form or another has been proved so profitable in the case of most of the soils of the State, should it usually be necessary appreciably to supplement the supply contained in animal manure.

It is therefore recommended that for coastal soils to be used for vegetable growing a goodly application of farmyard manure (say 20 tons per acre) be incorporated with the soil during the early preparation of the land. If this be done the only artificial fertiliser that should be required is superphosphate, at the rate of about 3 cwt. per acre, or a mixture of equal parts of superphosphate and bonedust at the same rate. Phosphatic fertilisers have a marked influence on the development of the root system of plants, which development in turn is an important factor in the production of maximum yields; but use of such fertilisers tends also to earliness, which also is frequently significant. The phosphoric acid in superphosphate is readily soluble, whereas in bonedust it becomes available gradually as the fertiliser decomposes. For this reason bonedust is of particular value in districts where the rainfall is heavy and where leaching of plant-food is likely to occur.

With regard to farmyard manure, there is no doubt that familiarity, or a consciousness of the plenitude of the material, too often breeds contempt. There are many farmers, particularly in dairying districts, who are purchasing artificial manures and allowing supplies of farmyard manure to go to waste. Examination of the value of the latter, based upon what it would cost to purchase the plant-foods that it contains in the form of artificial fertilisers, is interesting.

Allowing for the loss of plant-food (particularly of nitrogen and potash) that occurs as a result of the manner in which farmyard manure is treated on most farms, a conservative estimate of the plant-food content in 1 ton of the material may be reckoned as 8 lb. nitrogen, 6 lb. phosphoric acid, and

6 lb. potash. To supply equivalent amounts of these plant-foods in the form of artificial fertilisers would require 40 lb. sulphate of ammonia, 36 lb. superphosphate, and 12 lb. sulphate of potash. The value of these substances at the ordinary price per ton, landed on the farm would be :—

	s.	d.
40 lb. sulphate of ammonia, at £20 per ton	7	1
36 lb. superphosphate, at £7 per ton	2	3
12 lb. sulphate of potash, at £18 per ton	1	11
	11	3

This cost would be greater where the distance from the source of supply was very appreciable, and would also be increased, of course, if the fertilisers were purchased in smaller quantities. Moreover, this valuation takes no account of the organic matter of which the manure so largely consists, and it is just the value of that organic matter to Australian soils which is often not fully appreciated. It is quite safe to say that the organic content of farmyard manure is at any rate of equal value to the plant-food content, for organic matter improves the texture and mechanical condition of the soil, and increases its moisture-holding capacity, and upon these last-mentioned qualities in a soil plants are just as dependent as upon the supply of plant-food. Indeed, the beneficial effects of any artificial fertiliser are largely lost unless the soil has the characters (texture and moisture) imparted by organic matter, and they are proportionately increased by its presence. To realise this one has only to observe the results attending the use of superphosphate on the rich alluvial soils of the coast.

In the growing of most vegetable crops farmyard manure must be considered superior to all other fertiliser materials, and the use of artificial fertilisers must be regarded as supplementary only.

Rotted Wood and Bark as Manure.

Would the Department inform him, wrote a correspondent recently, of the manurial effect on young orchard trees of the application of rotted wood and bark from a compost heap. Would the use of such rotted matter, in conjunction with cow manure, be advisable in a flower bed?

The writer was informed that application of such material should prove of great benefit, and the more so if the soil was lacking in humus and organic matter. Its incorporation with the soil would increase the water-holding capacity of the latter and bring about more active bacterial growth, though no great amounts of plant-foods would be added to the soil, and it might be necessary to supplement the supply of these in the form of suitable artificial manures. Such rotted matter mixed with cow manure could be used on flower beds with profit.—A. A. Ramsay, Principal Assistant Chemist.

Poultry Notes.

July.

JAMES HADLINGTON, Poultry Expert.

If the advice given in last month's notes has been acted on, quite a large number of eggs should now be undergoing incubation and some chickens should already be out. Still, many farmers are not yet able to fill their incubator capacity, but should not be discouraged on that account, as it is a seasonal experience. Expectations are not usually realised so early in the winter, and it is quite a common experience for July to be well advanced before sufficient eggs are forthcoming to fill up all available incubator space. However, the aim should be to set all suitable eggs and so to secure what chickens are possible.

Rearing.

My remarks in last month's notes on the tendency to experiment in incubation, apply equally to brooding; the farmer who is always trying out some new idea is the one that is always in trouble. Not that one should settle down into a rut without any attempt to improve, because poultry culture, like every other activity, must be progressive, but a constant round of promiscuous experiments with one's means of livelihood is not good business. If it is desired to carry out experiments, let them be on such a scale as not to interfere with the main operations. It would appear that the ambition of average poultry farmers to succeed, engenders a spirit of restlessness: anything new or novel, or even an exploded theory, appeals to them with an intensity unequalled among any other class of producer. Much of this leads to retrogression instead of progress. The great need is for closer application to facts that are the result of practical experience.

How Many Chickens.

In view of the high cost of feeding and of the general outlook with regard to probable prices for poultry products in the immediate future, it will be more than ever necessary for poultry farmers carefully to plan their rearing this season. There is no apparent reason why flocks should be allowed to go down by curtailment of the number of chickens to be reared; that I believe would be a most unwise policy to pursue. At the same time there is a medium course, and that should be an endeavour to maintain existing numbers without attempting to increase them to any great extent, except, of course, in the case of the person who is working up an original flock. In the latter case, too, it will be prudent not to overreach one's resources.

This warning is deemed necessary in view of the fact that there is usually an insatiable desire on the part of the farmer for more, and still more chickens, or else a disposition to look on the black side of things and to fail to hatch sufficient to maintain existing numbers. There are many poultry farmers who do not look at the business side of things, and who go on blindly, as it were, attempting to raise all the chickens they can possibly hatch, often straining their resources to purchase extra incubators or day-old chickens that they could very well do without. These men have one object only in view—numbers—and often give no thought as to how the chickens are to be accommodated or even fed to a profitable age. The optimism that is at the root of such a practice is based upon an expectation that the resultant pullets will come on to lay, and pay for their feed and working expenses from the time they are 5 or 6 months of age. If this expectation could be relied upon to materialise, then all would be well, but the fact that it rarely does materialise makes a warning necessary. Again, there is the farmer who perhaps has had a favourable experience in getting a good return from a season's pullets; but it is not safe to presume on such an experience being repeated each year, such are the uncertainties attached to poultry farming. Much the safest plan is to assume that the pullets may not be profitable until the end of June of any year—for even if they are, the chances are that it will take all the proceeds to carry the second year hens through their slack laying period, and the farm as a whole, though perhaps sound on a stock-taking basis, will not for the time being give a sufficient return to support its owner. The meaning of all this is that the poultry farmer who relies too much on late summer and autumn egg-production is liable to meet with financial embarrassment.

Take a Business View.

This is the time of the year when the poultry farmer has control of the factors that may make or mar his prospects for the next twelve months. It can be taken as a general rule that the farmer who has a given number of laying stock, say, 600, 800, or 1,000, can afford to replace half that number in pullets each year, but just as soon as he essays to raise, in one year, more than half the number of layers he is keeping, though, of course, adding to his assets, he reduces his current net income.

Take, as an instance, the farmer who is carrying 800 head of laying stock, half of which will go out as aged hens each year. He would be said to be working on a basis of 800 layers, but assuming that by extra rearing he aims at raising his stock to 1,000 layers, then he must put on 200 additional pullets. When these are raised he has increased the value of his assets by £100, but as it has taken, say, £50 to rear the pullets and another £50 to house them, £100 has had to be found from somewhere, and though the value is on the farm, the farmer cannot have it as income—he must wait another year when a gradual increase of returns will be felt. In short, the extra

200 pullets and extra accommodation are an investment, and should be treated as such. It is the persons who are climbing such "hills" that are apt to complain that poultry farming is not paying, and many drop out by the way.

What is true of the specialised poultry farmer is none the less true of the farmer who is running poultry as a side line. Neither can expect their business to pay until the initial outlay on plant and stock is consolidated; that is to say, certain initial expenses must be incurred in plant and stock no matter how small the operations, and such capital expenditure cannot rightly be charged to the going concern, though of course the interest on the outlay is a fair charge. The same thing applies to every increase in stock.

There is only one way to determine whether a farm is paying, and that is by an annual valuation of plant and stock, including produce on hand, on a given date of each year, June or January for preference. To do this, there should be a set price for each age of bird being kept, and this valuation should stand as the stock-taking basis from year to year. Valuations should be on a safe basis of realisation.

It is quite impossible for anyone without plant and stock to start by buying a small number of birds, and make profit straight away. If the numbers are to be largely increased, the would-be farmer must be in a position to let his return be absorbed by the requirements of the increasing stock; he cannot have it in stock and in his pocket at the same time. In short it takes capital to start and more capital to increase the stock. This is not realised, and the impossible is being attempted every day, to the detriment of the poultry industry, as far as repute is concerned.

Food Substitutes.

Since 1914 there have been constantly recurring shortages of poultry food, which have given rise to a continual demand for substitutes. In this connection the Department has not been unmindful of the need. In fact it has all the time been on the look-out for any efficient substitutes for the usual pollard and bran. Various suggestions have been made in these notes from time to time with regard to articles that might take the place of one or the other or both. Unfortunately, as pointed out in a recent lecture, there is not in sight a cheaper substitute for the simple reason that anything that can be fed to poultry can also be fed to other stock, and thus the price is kept up. It is questionable policy on the part of the poultry-farmer, that he does not resort to some of the suggested substitutes, even though they may not be cheaper. This would at least augment the available supply of pollard and bran, and thus tend to ease the position, at any rate when, as now, drought conditions largely accentuate the position.

Some Suggestions.

As far back as 1915, and again in June "Poultry Notes," 1920, suggestions were made embracing a variety of foodstuffs that could be used, and the

quantities were given that would result in a balanced ration in conjunction with the usual cereals fed at the evening feed. The following are some o the quantities then suggested :—

Take 45 per cent. of pollard, or that article combined with bran or wheat-meal, and add 15 per cent. of good chaffed lucerne hay, another 10 per cent. in the green state, 10 per cent. coconut oil cake, 5 per cent. linseed meal, 10 per cent. millet meal, and 5 per cent. M.I.B. meat or Compo meal. Oaten pollard or wheatmeal could take the place of pollard with very little alteration in the balance of the mash. All these percentages should be worked on weights.

Lucerne meal, dust, or chaff, as part of the morning mash, was originally introduced into the feed of the birds at the egg-laying competition, principally as a means of adding variety, but it has since been recommended, both in this direction, and also as a means of cheapening the food. The last consideration depends upon current prices. At one period lucerne products were obtainable at £2 to £3 per ton lower than the prices ruling at the time for pollard and bran. Lucerne is, of course, subject to just as great fluctuations in price as the other articles mentioned. At the present time, with lucerne products at £12 per ton, its use is not economical, and while I would not advocate leaving lucerne out of the mash altogether, its use might be restricted to 5 or 10 per cent., and its place taken by wheat-meal or almost any of the other meals, or, if available, chaffed green lucerne might be used for the time being, until lucerne products become cheaper. It is understandable that, with prime lucerne hay commanding £10 to £11 per ton, lucerne meal must be very high in price. The time will come again when it will be less than half its present price, and then will be the time to increase its use in the mash. The reason for not eliminating it altogether is to keep the birds used to it. Laying hens do best on food they are accustomed to; one of the worst practices in feeding is sudden change of food. The aim should be variety, but not change of food.

In regard to the evening feed, nothing as yet known can supplant wheat or maize, or both, as the cereal portion of the ration, but they might be augmented by the use of grains such as oats, barley, or sorghum or millet seed. Of the latter, however, 10 to 20 per cent. is sufficient; oats may be used in place of wheat or maize to a similar extent.

The Balanced Ration.

It would be well if the poultry farmer were to disabuse his mind of the notion that he can feed an exact balanced ration. The fact is that almost every sample of any particular food will differ somewhat from every other sample on analysis, and as it is not practicable to have every lot analysed, only something approximating a balanced ration can be fed. All that is practicable in framing a ration therefore, is to indicate the percentages of the various foodstuffs which chemical analysis would suggest as necessary to a balanced ration.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Growers who have crops suitable for seed purposes are invited to communicate with the Department of Agriculture, Sydney. This should be done in ample time to allow of an inspection of the crop to be made before harvesting.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Maize (varieties in order of maturity):—	
Sundown	J. S. Whan, Llangothlin.
Golden Glow	P. J. O'Sullivan, Ben Lomond.
Wellingrove .	Manager, Experiment Farm, Glen Innes.
	J. S. R. Crawford, Emu Swamp, Orange.
Golden Superb	W. H. McMahon, Pola Creek, Macleay River.
Iowa Silvermine	J. Morphett, Farm 863, Stanbridge *via* Leeton.
Funk's Yellow Dent	T. C. Weedon, Beverley, South Gundagai.
	J. R. Knapp, Bolong, *via* Nowra.
	L. B. Garrad, Milton.
	A. E. Brown, Mt. Keira.
Hickory King.	J. W. Henry, Bolong, *via* Nowra.
Leaming	Manager, Experiment Farm, Grafton.
	W. Ryan Oxley Island, Manning River
	E W. Alway, Jones Island, Manning River.
Manning Silvermine . .	W. J. Adams, Dumaresq Island, Manning River.
Golden Beauty .	R. Richardson, Tinonee, Manning River.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy	Manager, Experiment Farm, Grafton.
	F. Waters, East Kempsey.
	J. P. Mooney, Taree
Large Red Hogan	G. Levick, Taree Estate, Taree.
***Grain Sorghum*:—**	
Feterita	Manager, Experiment Farm, Coonamble.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Dwarf Kaffir and White Yolo	P. A. R. Gersbach, Leeton.
***Sweet Sorghum*:—**	
Early Amber Cane	Manager, Experiment Farm, Bathurst.
Selection No. 61	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Berry.
Selection No. 34	Manager, Experiment Farm, Yanco.
Saccaline	Manager, Experiment Farm, Berry.
***Millet*:—**	
Japanese	Manager, Experiment Farm, Coonamble.
***Lucerne*:—**	
	W. E. Myring & Sons, "Nungaroi," Pallamallawa.
	A. L Thomas, "Merrivale," Bedgerebong, *via* Forbes.
***Shearman's Clover (Roots)*:—**	
	J. H. Shearman, Fullerton Cove, *via* Newcastle.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

Green Manuring.

H. WENHOLZ, Special Agricultural Instructor.

THE accompanying illustrations show the best method of turning under a green manure crop. At Grafton Experiment Farm a crop of cowpeas was sown last November for green manure, following a cereal green fodder crop which had been cut in October. On part of the field where the cowpeas were thin a crop of Apple of Peru (False Cape Gooseberry) weed also came up, and the mass grew to a height of three or four feet.

Fig. 1.—Levelling the Crop with the Roller.

The single furrow mouldboard plough, with a chain attached to the swingle-bar, or the single furrow disc-plough will effectively cover such a green manure crop, but the objection to that method is that the green manure is laid down in a mass under the soil, and the sour mass becomes abhorrent to the young roots of the succeeding crop.

The use of the roller to flatten down the green manure crop (see Fig. 1), followed by the disc-harrow (see Fig. 2), to chop it up thoroughly and mix it well with the surface soil, followed again by a two-furrow disc-plough (see Fig. 3), ensures that the green manure is not only covered, but also thoroughly distributed through the soil beneath, leaving the soil in excellent condition for the next crop to be sown soon afterwards.

Fig. 2 Cutting the Crop up with the Disc-harrow.

Fig. 3. Ploughing under with the Disc-plough.

The Cultivation of the Bush Nut.

Mr. J. Waldron, Upper Eungella, has given a deal of attention to the cultivation of the Queensland, or Bush, Nut (*Macadamia ternifolia*), and has obtained some most interesting results. A giant nut (at least twice the size of the ordinary nut) produced by Mr. Waldron unfortunately has such a coarse thick shell as almost to render it useless commercially, owing to the great difficulty of extracting the kernel. In producing two excellent thin-shelled nuts, however, he has undoubtedly scored. One of these very considerately cracks in the shell for at least half its circumference.

The superior qualities of this nut are generally admitted, the barrier to its popularity having hitherto been the hardness of the shell. Last season seeds of Mr. Waldron's thin-shelled variety were distributed for trial among a number of local growers. It appears that the confectionery trade is finding that these nuts are suitable for its business, and is using them extensively.

In virgin scrub, which is its natural habitat, this nut tree is a shy bearer, but the same tree becomes most prolific once the surrounding timber is destroyed. Seeds generally produce good trees, which bear in four to seven years. Practically no cultivation is necessary, and as the trees will bring in an increased revenue each year, it is advisable that all growing trees should be protected and the produce marketed. Bearing trees return from 10s. to £2 per tree. They can be grown as shade trees on dairy farms, and thus serve a dual purpose.

This nut is known also as the Polar and Australian nut In flavour and nutritive quality it is superior to other commercial nuts, and any surplus over Australian requirements could doubtless be made the basis of a profitable export trade.—Reg. G. Bartlett, Assistant Fruit Expert.

Cold Storage as a Control of Fruit Fly.

Preliminary tests with fruit infested with fruit fly and fruit fly pupæ were conducted during the past summer to determine whether a period of twenty days in cold store at 35 degrees Fahr. would kill the fly. The results were distinctly encouraging, showing that after such treatment fruit intended for local use could be sorted over and the sound fruit sold, while fruit for export could be treated before shipment or on board ship for three weeks with the assurance that it could be introduced into another state or country without danger of fruit fly being imported at the same time.

The material treated comprised ten small parcels of fruit known to be infested, and included oranges, apples, peaches, nectarines, and pears In January and February of this year these were all placed in cold store at 34 degrees Fahr. for twenty days, except one lot which remained in cold store for twenty-three days. From the cold store the fruit was transferred to jars where it could be observed, and where any flies that are still alive could hatch out. Three months has now elapsed—ample time for the purpose, it is considered—but no flies have made their appearance, though flies have hatched from control samples of the same parcels of fruit, which had been placed in similar jars.

Further tests are contemplated with the object of determining whether temperatures 38 degrees to 40 degrees Fahr. will be equally effective, and also whether the length of time can be varied with advantage.—W. B. Gurney, Assistant Entomologist.

Orchard Notes.

July.

W. J. ALLEN and S. A. HOGG.

Planting

LAND that is to be planted as an orchard should have already been thoroughly prepared. Apples, pears, &c., should be put in this month, while citrus trees may be planted either at the end of August or early in September. In cold, late districts, only varieties of apples and pears suitable for export should be planted.

When planting, the greatest care should be exercised to see that the roots of the trees have plenty of space; no crowding should be allowed. The roots should be carefully examined and all bruised ones cut away. Care should also be taken not to plant the tree too deeply, as this is very often a cause of failure. The roots should be well spread out and evenly distributed around the hole, it being often a good plan to set the strongest roots in the direction from which the prevailing winds come, as they then tend to brace the tree. The right depth at which to plant is, as near as possible, the same depth as that at which the tree stood in the nursery, and the hole should be so dug that the centre is kept rather higher than the sides to allow the drainage to run from the base of the tree, not towards it.

When planting a large orchard it is not advisable to dig too many holes in advance of the planting, as if rain sets in, the holes become filled with water and get water-logged. If by chance this does happen before the tree is planted the water should be removed from the holes, and the walls of the holes broken in so as to make a fresh surface for the young roots.

Pruning.

During this month pruning operations should be proceeding. Young trees should be cut back, and, in forming the trees, care should be taken to select the branches into which the sap is actually flowing. It is often found that, in a young tree, the sap has only selected one of the three branches that were left the previous year. If this is found to be the case the tree should be correctly balanced by summer training, for in spite of all the cutting done in winter, the sap will at times persist in going in its selected direction and can only be checked and directed during the growing period. This may be done by stopping or nipping off the terminal buds of the strong shoot and encouraging the flow of sap in the direction of the weaker ones.

Too frequently it is found that the orchardist is inclined to exhaust his trees in their young stages by asking them to bear heavy crops of fruit, which they are not physically capable of doing. It is always best therefore

to have no thought of fruit at all when forming young trees (say for the first three years), but to aim at the development of a strong, well constructed, tree that in future years will be able to carry and maintain good crops of fruit. In some instances varieties of fruit trees, even after they have reached maturity, are very shy bearers. There are several reasons for this: it may be that the trees require pollenation, or, on the other hand, it may be a case of excessive blossoming. The Robe de Sargeant prune, for instance, blossoms so profusely that it really over-fertilises itself. The same applies in many districts to the Winter Nelis pear. In such cases it is an advantage to prune heavily so as to lessen the amount of blossoming.

It is claimed by some that an unpruned tree will invariably produce heavier crops than pruned trees, and, with a few exceptions, this is so: but there is little or no advantage in leaving trees unpruned except in the case of some varieties of apples, pears, and plums, which, after their third or fourth year, require to be left for a season or two unpruned, so as to develop their fruiting wood. This applies particularly to the Prune d'Agen prune, which may be reduced after its fruiting wood is developed.

Manuring.

The application of artificial manures to fruit trees has not, up to the present, proved an unqualified success. In fact, in some districts no benefit whatever has been derived from the application of these manures. Farmyard manure, however, is invariably found most beneficial, but unfortunately in most instances is difficult to procure. On the other hand, in districts where it is comparatively plentiful, its value is not sufficiently recognised. When applied to citrus fruits, artificial manures have proved to be very beneficial, but if the trees are growing vigorously and carrying their crops of fruit without being distressed in any way, it will not be necessary to make applications. On the other hand, if the trees are weak and unhealthy in colour, they may require some stimulant such as blood and bone, bone dust, sulphate of ammonia, or nitrate of soda. Even with such trees care should be taken to give only light applications, for there is a danger of the skin of the fruit being made rough and irregular.

Spraying.

It is recognised that prevention is better than cure, and even although there was no fungus disease showing in the district last season, spraying is always advisable, and is a cheap preventive. Where peaches are growing they may be sprayed with Bordeaux mixture or lime-sulphur, winter strength, for the prevention of leaf-curl. One thorough spraying in July has been found to be sufficient, but if the spraying equipment is not a high-pressure one, it would be advisable to apply the spray a second time about fourteen days after the first. The vines should be swabbed with sulphuric acid and sulphate of iron, to be followed later in the season with an application of Bordeaux mixture.

Harvesting Citrus Fruits

The picking of citrus fruits may be continued this month, and small consignments should be sent to the market so as to relieve the bulk of the crop. Extreme care should be taken when handling these fruits, as bruises, or even finger-nail marks, encourage the development of blue mould. Of course, oranges and lemons should be cut (not pulled) from the tree, and the lemons should be picked directly they attain their required size, although in appearance they may be quite green. Upon keeping they will turn to a nice yellow colour and be greatly improved in their appearance and texture.

Ellendale Beauty is one of the mandarins that does well along the coast between Taree and Wingham.

In Memoriam.

Mr. S. A. HOGG,

Died 23rd June, 1923, aged 53 years.

The Minister of Agriculture, the Hon. F. A. Chaffey, M.L.A., and the Under-Secretary and Staff of the Department of Agriculture, desire to record their appreciation of the late Mr. S. A. Hogg, whose sudden demise has removed from their circle a zealous and valued officer.

Upon the large number of students that passed through his hands during the twenty-one years he was Orchardist at Wagga Experiment Farm, and upon the many growers who turned to him for advice during that long period, Mr. Hogg's sound practical outlook must have left an enduring impression. Growers of dried fruits in particular will long have cause to thank him for the substantial amount of knowledge and experience he has left within the Department.

The lectures, demonstrations, and advice given, chiefly in the southern and western portions of the State, since his appointment as Assistant Fruit Expert, in October, 1918, confirmed and extended the repute in which he was held.

It is with a sense of his real value to the industry, as well as esteem for his personal qualities, that this tribute is indited.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society	Secretary.	Date.
Wentworth P. A. and H. Society	W. B. Crang	July 18
Peak Hill P. and A. Society	T. Jackson	,, 24, 25
Condobolin P. and A. Society	C. H. Leiferman	,, 31, Aug. 1
Bogan Gate P. and A. Society	J. Egan	Aug. 8
Parkes P. A. and H. Association	L. S. Seaborn	,, 14, 15
Forbes P. A. and H. Association	W. T. Gilchrist	,, 20, 21, 22
Corowa P. A. and H. Society	J. D. Fraser	,, 21, 22
Grenfell P. A. and H. Association	G. Cousins	,, 28, 29
Murrumbidgee P. and A. Association (Wagga)	F. H. Croaker	,, 28, 29, 30
Culcairn P. A. H. and I. Society	L. H. M. Newton	Sept. 4, 5
Manildra P. and A. Society	I. C. Longley	,, 5
Barmedman A. and H. Society	A. J. Meagher	,, 5
Young P. and A. Association	T. A. Tester	,, 4, 5, 6
Junee P. A. and I. Association	T. C. Humphrys	,, 6, 7
Cowra P. A. and H. Association	E. P. Todhunter	,, 11, 12
Cootamundra A. P. H. and I. Association	W. W. Brunton	,, 11, 12
Narandera P. and A. Association	W. H. Canton	,, 11, 12
Gunnedah P. A. and H. Association	M. C. Tweedie	,, 11, 12, 13
Murrumburrah P. A. and I. Association	W. Worner	,, 13, 14
Holbrook P. A. and H. Society	J. S. Stewart	,, 18, 19
Ganmain A. and P. Association	T. S. Henderson	,, 18, 19
Canowindra P. A. and H. Association	J. T. Rule	,, 18, 19
Temora P. A. H. and I. Association	A. D. Ness	,, 18, 19, 20
Boorowa P. A. and H. Association	W. Burns	,, 20, 21
Northern A. Association (Singleton)	J. T. McMahon	,, 20, 21, 22
Henty P. and A. Society	H. Wehrman	,, 25, 26
West Wyalong P. A. H. and I. Association	T. A. Smith	,, 25, 26, 27
Hay P. and A. Association	C. L. Lincolne	,, 26, 27
Koorawatha A. Society	J. A. Larson	Oct. 2
Ardlethan A. Society	R. Neill	,, 3
Ariah Park A. Society	J. F. McInnes	,, 10
Lismore A. and I. Society	H. Pritchard	Nov. 20, 21, 22

1924.

Society	Secretary.	Date.
Albion Park A. and H. Association	H. R. Hobart	Jan. 11, 12
Wollongong A. H. and I. Association	W. J. Cochrane	,, 31, Feb. 1, 2
Guyra P. A. and H. Association	P. N. Stevenson	Feb. 19, 20, 21
Moruya A. and P. Society	H. P. Jeffery	,, 27, 28
Newcastle A. H. and I. Association	E. J. Dann	,, 26 to Mar. 1
Manning River A. and H. Association (Taree)	R. Plummer	Mar. 4, 5, 6
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	,, 11, 12, 13
Crookwell A. P. and H. Society	C. H. Levy	,, 20, 21
Tamworth P. and A. Association	F. G. Callaghan	,, 25, 26, 27
Campbelltown A. Society	J. T. Deane	,, 28, 29
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 9, 10, 11
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 14 to 23

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Agricultural Gazette of New South Wales.

Conservation of Fodder.

PIT SILAGE FOR STARVING STOCK.

A. H. E. McDONALD, Chief Inspector of Agriculture.

DURING recent years considerable attention has been given to the problem of conserving fodder with the object of preventing, or at least mitigating, the losses which occur during droughts. A method that has been adopted with success by many farmers and graziers is that of conserving silage in pits. It is recognised by those who have preserved fodder in this way that it is not only one of the cheapest and safest of all means, but that the fodder itself is one of the best substitutes for green grass. The advantages of the method are so great that it deserves the attention of all stockowners who are in a position to raise crops suitable for the purpose. Droughts during recent years have shown that if stock are to be saved from starvation, reserves of fodder must be built up. In the days when land was cheap and there were no rabbits, stockowners could perhaps afford to take risks, but with the present high interest charges and working costs, the margin of profit is not so very great, and if the landowner's stock are destroyed by drought he has little hope of recovering his position and must give place to men who have more capital.

The enormous losses which have occurred during recent years indicate the dangers that attend the carrying of stock without provision of reserves of feed to carry them through periods of drought. The figures compiled by the Government Statistician indicate only the decrease in numbers of sheep, cattle, and other farm animals. They do not show the loss which occurred through a lighter and less marketable wool clip, the reduced flow of milk from dairy cows, and the loss of the beef and mutton which form so substantial a part of the stockowner's income. Neither do they indicate the loss which the stockowner experiences, after the breaking of the drought, owing to his holding being understocked.

The Advantage of Silage.

The making of silage can be fitted into the operations on a wheat farm without interfering unduly with the production of hay or grain. When it is intended to produce either hay or grain, seed must be sown at such a time as will ensure that the crop will be ready to harvest when the weather is suitable for the purpose; it would be disastrous to sow too early. Silage, however, may be made equally as well in June as in October or in any other month, and thus crops intended for silage may be sown before the hay or grain crop, and cut and pitted before haymaking is commenced.

Silage Means More Sheep.—A farmer to be successful in these days must carry a flock of sheep as well as grow wheat, and a good reserve of silage

will not only prevent loss during drought, but will enable him to increase the numbers of his flock because of the reserve of feed on which he can draw should the necessity arise.

Under present conditions, it is hardly possible for many wheat-farmers to carry more than a few sheep profitably, as the natural grasses of their holdings are not sufficient, even when helped by the wheat stubble, to provide feed for any length of time. There is no great inducement for a farmer to grow crops specially for feed when he knows that he will have to wait until the crops are ready before he can buy, and that he will then have to pay such a high price, because of the number of other farmers in the same position, that he will not be recompensed for the cost of growing the crop.

A Pit Silo.

It is undeniable that a better system of rotation is required in the wheat areas of this State than the almost universal wheat-and-bare-fallow. Sound as the practice of fallowing is, the adoption of it as the sole rotation with wheat will, within a very few years, so reduce the supply of humus in the soil that the yields of wheat will no longer be profitable. Such a condition is already arising in many soils, and will become more pronounced as time passes. In this country, where the rainfall is so uncertain, one of the most important constituents of the soil is humus, because it is one of the prime factors in helping the soil to retain moisture for a long period, and even the best fallowing will not yield good results in its absence.

The only practical means of restoring or maintaining a good supply of this invaluable constituent, other than allowing the land to lie out in grass for a long period, is to grow upon it, in rotation with wheat, a crop which can be fed down by sheep. The remains of the plants left by the sheep, and their excrement, become humus, and thus give to the soil the desirable moisture-retaining character.

The conservation of silage will enable the farmer to adopt such a rotation with greater certainty that he will make a good direct profit from his green crops, and also a larger indirect one because he will be in the position of being able to stock his land to its full capacity. Unless a reserve of fodder is held it is unsafe to increase his flock, as the green crops may fail to grow at the expected time owing to the absence of rain.

Moreover, a full silage pit enables him to lamb his ewes with certainty. Should a dry season threaten at the mating time he need not be afraid to join the rams in the usual way.

Silage Means Less Worry.—Another consideration which should weigh heavily with anyone who has to deal with stock is the enormous load of anxiety which is lifted from the mind of the fortunate possessor of a store of silage. The man who has a good reserve can carry his sheep along on the grass up to the last moment, and when, in the ordinary course of events, some of the weaker ones would be dying through lack of food, he can turn to his silage with the satisfactory feeling that although things have got pretty bad he is still right for a further few months, and that it is very unlikely that it will not rain before his feed supply runs out.

Farmers May Assist Graziers.—Even if a farmer does not require silage for his own use, its conservation may be made very profitable because of the prices which can be obtained for it during drought periods from owners of starving stock. During the last drought many thousands of sheep were brought into one western district where lucerne hay was available. To enable silage to be utilised in this way it is necessary that ample water shall be available. On very many farms in the western and north-western districts unlimited water is provided by the sub-artesian bores, and the owners have an opportunity of helping graziers, with profit to themselves, by making silage.

What is Silage?

Silage is the green crop cut and placed in the silo or stack while still in a green, fresh condition. Hay, on the other hand, is not stacked until the moisture has been removed by drying in the field. Practically no chemical and bacterial action can take place in such dry hay. If, however, the hay is not sufficiently dried out it will ferment, and if it becomes wet with rain it will mould. In some cases, hay that is brought in before it is sufficiently dry will blacken, and where the amount of moisture is fairly considerable it will cure in the stack to a brown colour and will, in fact, be converted into a kind of silage. Brown lucerne hay is stacked before it is thoroughly dried out and is practically a form of silage.

In the case of hay, the aim is to dry the material sufficiently to prevent any fermentation or other change after it is placed in the stack. In making silage, the idea is to encourage fermentation for a time at least.

Vinegar, wine, beer, cheese, &c., are all produced by different processes of fermentation, substances being produced during the process of fermentation which act as preservatives so long as the air is excluded. In the case of silage, the changes which occur in the green material after it is stacked are partly caused by fermentation and partly by a continuance of the living processes of the plant. When it is growing a plant absorbs carbon dioxide from the air, and water, nitrogen, potash, and other substances from the soil, and bringing all these substances together and forcing them to act upon one another, converts them into leaves, stems, and roots. Other substances, such as sugar and starch, which are not so apparent, are also produced.

When the green crop is cut, it does not die immediately, but the living processes of the plant continue for some time Respiration is one of the processes that goes on, until certain changes have been effected in the plant material, but when the crop is put into the silo the exclusion of the air prevents the continuance of respiration for long, and hence also some of the changes. As a consequence certain intermediate products such as acids are formed. These various changes develop a considerable amount of heat and raise the temperature of the silage. After a time the chemical changes cease, partly because all the plant material upon which the chemical forces can operate has been used up, and partly because all the air that is mixed up with the silage has been exhausted. No further change can then take place so long as the air is kept out.

To make silage satisfactorily, therefore, it is necessary that the crop shall be green when it is put in the silo, and that the air be excluded as much as possible. There is no difficulty in keeping the air out of pits or properly-constructed overhead silos, but it is practically impossible to keep it out of stacks, and therefore while there is rarely any loss of silage when made in pits, there is generally a good deal of loss when it is made in stacks.

Pit Silage.

In the wheat-growing districts, especially where the silage is intended for sheep, the pit method is undoubtedly the best, for by it silage can be made with the minimum amount of labour, and with a minimum loss of material. The pit is not rivalled even by the most up-to-date silo, as with the latter the material must be chaffed, which means greater expense both in making the silage and also in feeding it to stock. In the case of the pit the crop is put in whole, and when taken out it needs only to be spread over clean ground for the stock, whereas the chaffed material that goes into an overhead silo must be put out in feeding troughs of some kind.

Crops Suitable for Silage.

To make good silage, it is essential that the material used should contain the right amount of sap. If it is too dry, it is likely to mould or char—that is, the heat generated, although not causing actual burning, will produce

a charred condition of the material and render it useless. If, on the other hand, it contains too much sap, a mushy, evil-smelling product will be produced, which in some cases will be quite valueless.

Crops of wheat, barley, or oats which have made good growth and have not been withered by drought are in the best condition just after the ears appear. Even when they have made rank growth, these crops do not contain too much moisture. At Coonamble Experiment Farm, silage of extra good quality has been made from barley grown on black soil, which had lodged so badly through rank growth that it was extremely difficult to cut. This crop was cut before it had all eared in August, and was put straight into pits. At Condobolin Experiment Farm barley was also used, and at Trangie and Nyngan Farms silage has been made from wheat. In every case the silage was excellent.

Wheat, oats, and barley are the most generally useful crops for silage in the western districts. They are easy to grow and to handle, and the silage is easily removed from the pit, and is readily eaten by sheep. Practically no loss is made when these cereals are conserved in pits. As just stated, they should be cut just after the ears are well out, or even before that stage if necessary, though by waiting till the ears are well out more weight is obtained. Many farmers, when cutting wheat and oats for hay, wait until the grain is well formed, but as there must be plenty of sap in the straw to make good silage, crops intended for this purpose must not be allowed to form grain, as the straw may then be too dry to make good silage. Cutting with the reaper and binder is the most economical method, as sheaves are easrier to handle than loose stuff. Furthermore, the sheaves can be laid down in the pit in an orderly way, and when the pit is opened the silage can be removed without the slightest difficulty. Silage made from crops cut with a mower gets into a very tangled condition, and is difficult to remove from the pit.

Black oats cut before the seed is formed makes splendid silage, so that the farmer can clean his land and conserve useful feed at the same time.

Maize and sorghum make good silage if cut when the cobs are well formed in the case of the former and when the heads are well out in the latter. Both crops, especially maize, are affected by frost, and they dry out rapidly after a frost. They should therefore, if at all possible, be cut before they are frosted. In dry times, particularly in western districts, these crops may dry off prematurely, but if cut in time they will make good silage. Rape cannot be converted into silage owing to its excessive sappiness. Even stray plants of rape mixed with barley put into the silage-pit at Coonamble came out mushy and useless.

Among natural herbage, trefoil and variegated thistles make good silage, but it is as well to let the material wilt a few days before putting it into the pits. It is doubtful whether very succulent herbage such as crowfoot will make good silage. It contains so much sap that it would be risky, though if it were allowed to dry somewhat and could be mixed with drier material, it might turn out satisfactorily.

As plenty of moisture in the crop is essential to the making of good silage, it is obvious that dry material, such as many western grasses when in flower, cannot be used for this purpose. Neither is it possible to utilise such weeds as Star thistle, Black thistle, &c.

Selecting a Site for a Pit.

Pit silage cannot be made where there is water seepage. For this reason the method is not always successful on the coast. Even on many coastal farms, however, particularly on the South Coast, where granite or sandstone formations occur, suitable sites for pits could be found. In inland districts suitable sites can be found on practically every farm.

A high spot should be selected and the pit, if possible, made on the crest of a rise, though this is not essential. What is necessary is good drainage, so that water will not run into the pit. Care should also be exercised to ensure that the site will not be subject to floods. On Coonamble Experiment Farm the land is practically level, and is subject to flooding in very wet weather, but there has been no difficulty in securing sites on low rises. Any red soil is suitable, and sites should be selected on such soil in preference to black soil, which is generally low-lying and likely to crack in dry weather and to admit water after heavy rain.

It is, of course, an advantage to have the pits as near as possible to the crop that is to be made into silage. Consideration should be given to the question of convenience in feeding, but as a rule the nearer the pit is to the crop the better, as it saves expense in filling.

Making the Pit.

A handy size is a pit capable of holding about 100 tons. Such a pit is easy to fill, the silage can be got out without difficulty, and generally it will be found that when opened it is all used. If the pit is larger it is quite possible that before the silage is all used, the drought will have broken and grass have become available in the paddocks, which means that feeding will be discontinued before the pit has been emptied. The pit will then have to remain open for perhaps months, until crops have been grown to refill it.

If only a few hundred sheep, say, 300 to 500, are kept, then the pits may be made smaller. A pit about 65 feet long, 21 feet wide, and 6 feet deep will hold 100 tons. The pit should be made with batters of about 3 to 1 at the ends, but with the sides almost perpendicular. There is not much difficulty in making such pits. If necessary the pick could be used to clean up the sides, but by adjusting the plough with an extension to the bridle, or by using the horses tandem when ploughing, the sides can be kept practically perpendicular. Batters are required at the ends, as the drays are drawn right into the pit in the process of filling, and also when the silage is being taken out.

There is no advantage in making the pits deeper than 6 feet. In fact, greater depth is a disadvantage, as the pit is more difficult to make and it is harder to remove the silage.

Two men with about three good horses, a strong but light single-furrow plough, and a light half-cubic-yard scoop will put down a pit comfortably in two weeks. The cost per yard will be slightly greater than the usual charge for tank sinking, but will not exceed 2s. per yard, which is equivalent to a cost of 4s. per ton of silage. There should be no difficulty in getting contractors to excavate the pit at 2s., or even less, per yard. Once made it will last for years, and may be filled time after time.

Each cubic yard of such a pit will hold about half a ton of silage. A handy way to reckon is 2 yards to the ton.

Filling the Pits.

The special considerations that have to be given to each crop have already been discussed, but a few points connected with their handling remain to be mentioned. Only as much crop as can be put into the pits should be cut each day. As the crop is in a sappy condition when being cut for silage and the mornings are usually damp, cutting should be done each afternoon.

A team of about six men is required—one to drive the binder and to help with the waggons when he has cut enough crop for the day, four men with two waggons, lorries, or drays, and one man in the pit.

If only 80 to 100 tons are to be made the work can be done quite easily by three men.

When making silage, everything should be done to pack it as closely and tightly as possible. The sheaves must be placed in the pit lengthways, the bands being cut, though it is not necessary to remove them.

The waggons may, of course, be drawn into the pits from the commencement, but it is not altogether necessary to do this at first. Later when the pit has been filled to about the ground level, or nearly so, the waggons are drawn right into the pits for unloading. This compresses the silage.

When the pit has been filled to slightly above the ground level, work on it should cease for a couple of days to give the silage a chance to settle. It is a great advantage to have two pits, so that one may be settling while the other is being filled. If only one pit is in use work should be stopped for two or three days, or at any rate delayed, to allow the settling to take place. Filling may then be resumed and the material stacked until it is about 4 feet above the surface at the centre. The stack should slope away gradually towards the ends. A further period should be allowed for settling, and when this has taken place the filling should be continued.

Careful note should be taken of how the pit settles, as this gives a good indication as to when it will be safe to stop. When it is considered that the material has settled thoroughly the stack should be again built to a height of about 4 feet. Working this way to allow periods for settling, and spreading the work over a fortnight, the pit is generally so compact that when covered it will not settle below the land surface level. Even when allowing for plenty of settling, and leaving a stack of about 4 feet, the material will, after a few months, sink down until only a slight mound is left. It is very important to get the pit well filled, otherwise after a few

weeks the site of the pit will be marked by a deep depression, which means that not only is some of the storage capacity not utilised, but water can run into the pit and damage the contents. A well-filled pit a few weeks after filling will show just as a small mound. It must be remembered that, even when pressed in as tightly as possible, the material is, comparatively speaking, loosely packed. The heat generated softens the stems, and the enormous pressure of the greenstuff above, together with the covering of earth, presses it together, until finally it becomes almost as solid as a plug of tobacco.

Rain on the silage while it is being made does not in any way damage it. If the material is rather too dry, rain actually improves it. Indeed, many farmers add water to such material to insure that good silage shall be made.

Covering the Pit.

After the final filling it is advisable to allow the material to settle for two or three days. This reduces the height and renders covering easier. If the rate of settling is very slow, it may be taken for granted that the pit has been well filled. If there is any doubt, the work of covering may be deferred for a week. The delay will not result in any appreciable loss, and will show whether further filling is required.

The work of covering is done with a scoop, the earth being scooped straight on to the top of the greenstuff. Practically no loss of material occurs. Some pits when emptied have only shown about 2 inches of loss at the surface. It is quite unnecessary to give a deeper covering than 9 or 12 inches of soil, as it does not protect the silage any better, and only involves greater expense in covering and in removing the soil later.

It will be noted that nothing has been said in regard to noting the temperature of the material as the pit is being filled. This is not an oversight. It has not been mentioned because it is not necessary. It can be taken as a certainty that if the crop is cut at the stage indicated and put straight into the pit, the result will be satisfactory, and there is no more need to take the temperature than there is when building a haystack.

Feeding the Silage to Sheep.

The pits are uncovered by simply removing the earth with a scoop. If any earth happens to get mixed with the silage, it is shaken out when the fodder is being thrown to the stock. It is preferable to open up a section at a time —say 16 feet of the length of the pit. The silage will be found to have a coating of perhaps 2 or 3 inches of rotten material, and this should be kept out of the way of stock, which are liable to eat it if starving, with harmful results. The silage becomes densely packed and almost as solid as wood, and is cut out in "benches" of about 4 feet the full width of the pit with an axe or an adze. When a clear face is obtained and a block is cut, the material can be lifted out quite easily.

One man can feed 800 to 1,000 sheep daily, giving them a liberal allowance. The silage need only be thrown over a clean piece of ground, but it should be well spread out. It is better to get a good deal out every day

before the sheep are allowed to feed, as they not only surround the waggon and get in the way of operations, even to the danger of being injured, but the strong ones run ahead, picking the choice bits and trampling over the remainder. Sheep should be drafted into lots according to their strength for feeding. If this is not done, the strong ones take all the best of the silage, and leave only the coarse stuff for the weaker ones.

Feeding should be commenced while the sheep are still in good strong condition, and while there is some rough grass about. They do better under such circumstances and make better use of what rough feed there is than if the silage is withheld until they have become low in condition and all the grass is gone.

Feeding Silage to Sheep at Coonamble Experiment Farm

Sheep do fairly well on silage alone if feeding has not to be continued too long, but after they have been fed on silage exclusively for a couple of months they commence to go off in condition. This is due to the fact that silage is of a succulent nature, and is lacking in protein. It is not such a properly-balanced food as that which sheep pick up in paddocks where there is a mixed growth of grasses and clovers or trefoils, the latter of which are especially rich in protein. It is therefore advisable not to feed silage alone, but to combine with it a small quantity of wheaten, oaten, or lucerne hay—preferably the last-mentioned, because of its high protein content. Notwithstanding all this, it is, of course, true that during the last drought many sheep were satisfactorily fed on silage solely

The silage ration will vary according to the amount of feed to be picked up in the paddocks. Mr. W. E. Tayler, of Adavale, Parkes, fed 1,000 sheep

during the last drought at the rate of 1 lb. per head daily while there was some stubble available, and when this had been destroyed by rain he increased the rate to 2 lb per day. At Trangie Experiment Farm 2 lb. of silage, with ½ lb. of lucerne hay, was allowed per day. This was varied occasionally by feeding 2 to 4 oz. of maize per day with the silage instead of the lucerne. A plentiful supply of salt should be provided for sheep when feeding on silage, even in districts, such as saltbush country, where it is ordinarily not used to any extent. The lick is improved by adding about 6 oz. of Epsom salts to about 100 lb. of coarse salt.

Loss of Silage in Making and Feeding.

In the pit method practically no waste occurs. After feeding out one pit of about 90 tons, only a few straws could be seen lying about the pit and paddock. The total waste in the pit and while feeding did not amount to more than 1 per cent. of the material originally put in.

The Cost of Making Silage.

Silage is the cheapest form in which fodder can be conserved. This is owing to the small amount of handling required after the crop is cut. When hay is made it has to be stooked and stacked, and then protected from the weather, mice, &c., and to protect hay satisfactorily an expensive shed is required. In the case of silage the amount of handling is reduced to the minimum. Immediately the crop is cut it is carted to the pits, and when these have been filled and a little earth has been scooped over as a covering the job is finished. The cost, therefore, consists only of growing the crop, cutting it, and filling the pits.

The cost is necessarily influenced by the yield. A good crop suitable for silage will yield about 8 tons per acre. To produce such a crop will not cost more than £2 per acre (a liberal estimate), or 5s. per ton. Cutting and carting will cost about 4s. per ton, while 1s. per ton represents a very fair charge for the pit. The total cost will therefore not exceed 10s. per ton for the production of the crop and the making of the silage. On some of the experiment farms and on the farm of Mr. W. W. Watson, Tichbourne, it has been made at less than 6s. per ton.

The Value of Silage.

The value of silage is very well shown by the experience of Mr. Tayler (already referred to) during the recent drought. He writes:—

"I commenced to feed 1,000 ewes in lamb in the middle of February at the rate of half a ton of silage per day. They were running on about 800 acres of stubble, with absolutely no grass or herbage. This quantity, with plenty of salt lick, kept them in good condition for about six weeks, when a rainstorm of about 40 points destroyed the stubble altogether, and I was left with practically no natural feed of any sort. I then increased the ration to 2 lb. per sheep per day, and, finding that not sufficient, added a ¼ lb. of maize or wheat per sheep per day. This ration was given up to the end of June. The sheep did fairly well and dropped 50 per cent. of lambs."

These facts are worth figuring out. The 150 tons used in four and a half months cost, say, £75. Adding interest on capital during the time it was stored (three years), the total cost is approximately £100. If it is estimated that 100 tons of wheaten or lucerne hay would have taken its place—allowing such hay to have equal feeding value, which is very doubtful—Mr. Tayler's feeding can be compared as follows:—

100 tons wheaten hay, stored on the farm, at £3 10s. per ton, £350—a saving in favour of the silage of £250.

100 tons wheaten hay to be purchased at £4 10s., £450—a saving of £350.

100 tons lucerne hay, at £8 per ton, £800—a saving of £700.

The market value of silage is not fixed, as is the case with hay. In nearly every case the fortunate farmer who possesses it regards it of so much value

How the Sheep appreciated Silage at Coonamble.

to himself that he will not sell it. It has, however, a very definite market value. During the recent drought the manager of Wagga Experiment Farm was offered £8 per ton for pit silage. Considered from the point of view of its actual food constituents it may not be so valuable as hay, but its succulence is an important feature and renders it of considerable value, particularly in time of drought, when succulent feed is the very class of which there is a special scarcity.

Pit Silage for Dairy Cows.

Pit silage has been considered in the foregoing principally in relation to its value to the sheepowner. This is because it can be most largely made in those districts where sheep are of greatest importance. Its use, however, is by

no means restricted to sheep or sheep country. Pit silage is of equal value to the dairyman, whether in the interior or (where its preparation is practicable) on the coast. At Wagga Experiment Farm it is used regularly to feed the dairy herd, and so cheap has the pitting method been found, and so satisfactory the product that the pit is now regarded as quite superior to the overhead silo.

The pitting method is found satisfactory on the coast, provided a suitable site is obtainable. There is no doubt, however, that in the case of the coastal dairy-farmer the general convenience of making and feeding warrants the erection of overhead silos.

Lucerne for Silage.

No one has had more extensive experience in the making of pit silage than Mr. Anthony Brunskill, of Allonby, Wagga. He considers that there is no fodder to equal it in regard to cheapness, keeping quality, and freedom from damage by mice, fire, birds, or storms.

There is no fodder that stock will do so well on during drought as silage. its succulence keeping the animals in a healthy condition, whereas animals forced to feed entirely on dry material suffer from impaction and other digestive disorders. It is nevertheless advisable to give stock that are being fed largely on silage a dry ration, such as hay, once or twice a week, unless there is some natural grass in the paddocks. Silage is particularly valuable for lambing ewes, as it is a great milk-producer, and keeps the ewes in just the right condition for raising lambs.

Mr. Brunskill considers that the conservation of fodder in this way in good seasons is the cheapest, most practicable, and best means of solving the problem of fodder conservation and of preventing losses during drought. If a man is not in a position to conserve some fodder as silage in good years, then he is certainly in a much worse position to stand the loss of stock in times of drought.

Mr. Brunskill has been conserving fodder as silage for the last twenty years, using principally the first lucerne cut of the season, and his experience has shown that it can be cut and put into the pit by his method at a cost of 4s. per ton for labour. To this must be added the cost of the pit, at 1s. per cubic yard, about 2 cubic yards going to the ton. The pits, however, last for years. If silage were being made from natural herbage the cost would be greater, as the yield per acre would be lighter and the material would be less easy to handle.

The pits, which are excavated in close proximity to the crops, are usually made 80 feet long and 16 feet wide at the top, with both ends sloping down to a depth of about 8 or 9 feet. They have a batter of about three to one at each end, which allows the lorries to be easily run through the pit during filling. The pits are about 14 feet wide at the bottom, which leaves the sides with a very slight slope. For filling it would be an advantage to have them quite perpendicular, but it has been found that, with a slight slope inwards, the pits stand up better when empty, and therefore last longer;

pits with perpendicular sides are more likely to fall in. A pit of the above measurements has a capacity of about 260 cubic yards, and will hold about 140 tons of silage made from heavy green lucerne.

A hay-loader is used for the loading of the lorries, and seven men fill the pit in four days. After the mowing machine has cut around the block of lucerne, a side-delivery, or sweep, rake follows and sweeps the lucerne into a row. A lorry with a loader attached follows the rake, the loader elevating the lucerne on to the lorry as rapidly as any one man can spread it. When the first lorry has been loaded the hay-loader is detached and hooked on to the second lorry, while the loaded lorry goes on to the pit.

Before loading is commenced, preparations are made for the whole to be easily unloaded in one act by placing a rope on the bottom of the lorry, with the two ends fastened to the back and the loop hanging loose in front between the two horses. When the lorry reaches the pit another rope is thrown over the load from behind and hooked on to the loop of the rope that lies in the lorry beneath the load. The loose end of the second rope is then half hitched around a post and the lorry is driven into the pit; when it has reached the point at which the load is to be taken off the rope is secured to the post, and, by keeping the lorry moving, the load is automatically removed without hand labour. It is easily levelled off by a man before the next load is carted in.

The constant passage of horses and lorries over the surface of the pit presses the silage down tightly, but when the pit is about half full it is advisable to apply a little more pressure, especially to the portions along the sides, which the lorries and horses do not reach. This is done by a lad driving three horses coupled abreast, backwards and forwards over the silage.

The pit is built up to about 6 or 7 feet above the surface, with straight sides but with a slope from the centre towards the ends, as the greatest settling will occur where the pit is deepest. After three or four days the silage will have settled down to within 3 or 4 feet of the surface. Careful attention is given to the filling of the pit, particularly in regard to pressure and the stacking above the surface, so that when the silage has become well settled the surface will still be above the ground level. After the silage has settled for three or four days, earth is scooped over the surface so that it is covered all over to a depth of a foot or 18 inches, and a drain is made around the pit on the solid ground to draw water off the crown. If the pit has been well filled it will ultimately settle down to about 2 feet 6 inches above the ground level at the centre, and will be quite safe. If it has not been well filled the contents will settle too much and water will be held on the surface.

Mr. Brunskill states, in conclusion, that although he has made a great quantity of pit silage and had twenty-seven pits filled at the commencement of the last drought, he has never had a failure. Before using the pit method, many years ago, he made silage in stacks, but it was found that this method, while very laborious, was also uneconomical. Some of the stacks fired, and in the others there was a big percentage of waste.

Sorghum Experiments on the Upper North Coast.

E. S. CLAYTON, Agricultural Instructor.

A VARIETY trial with sorghum and Sudan grass was conducted during the season 1922–23 on Mr. Grenenger's farm at Bonville. The trial was carried out on brownish-red, second-class volcanic soil. The land was well prepared and worked into a fine tilth prior to sowing, which took place on 7th October, the seed being dropped by hand in rows 2 feet 9 inches apart. The germination was excellent throughout. The rows were cultivated as required to destroy weeds and conserve moisture.

The season was rather hot and dry, a severe drought being experienced over the whole of the North Coast. The rainfall was as follows:—October, 254 points; November, 133; December, 173; January, 680; February, 363 March, 616; total, 2,219 points. Excellent growth was made throughout the plots, the feed being cut and fed to dairy cattle. The fodder was extremely useful, as the pastures were very short on account of the hot, dry season. The yields are shown in the following table:—

Variety	First Cut. Date.	First Cut. Yield per acre.		Second Cut. Date.	Second Cut. Yield per acre.	
		t.	c.		t.	c.
Saccaline	6th February ...	19	1	26th April ...	15	13
Early Amber Cane	2nd February ..	16	17	23rd April ...	10	16
Sorghum No. 61	27th January ...	12	13	21st April ...	12	0
Sudan Grass	31st December ..	8	0	19th February...	7	15

Saccaline has again demonstrated its superiority over the other varieties of sorghum for the North Coast. It is a late-maturing variety, and is very useful in providing a large bulk of feed and standing well into the winter.

The value of Sudan grass as a grazing crop should not be lost sight of by the North Coast farmer. It is particularly useful as a quick-growing, summer grazing crop during a drought such as was experienced on the North Coast last summer.

"KIKUYU grass is the king of grasses as far as this locality is concerned. When all other pasture was killed by the recent drought the Kikuyu remained green and sturdy. The stock are extremely fond of it, and appear to prefer the Kikuyu to wheat, barley, or Sudan grass. I gave roots to several neighbours. All are enthusiastic about its feed value and drought-resisting properties."—Report from a farmer in the Liverpool district.

Some Valuable Additions to our Useful Pasture Grasses.

J. N. WHITTET, Agrostologist.

DURING the past eighteen months a large number of exotic and indigenous grasses, in addition to some which have proved their usefulness during previous years, were grown under cultivation for the first time in New South Wales, and it is forecasted that some valuable additions to our well-known pasture grass have been obtained as a result.

The exotic species were received, in the majority of cases, from the United States of America, South Africa, and India, and although the past season has been very exacting, owing to the dry conditions which prevailed in most parts of the State from August, 1922, to June of this year, some of the species have made better growth than our well-known native and introduced grasses.

All are still under investigation, and further trials are to be conducted before seed will be available for distribution to farmers and graziers.

Panicum antidotale Retz.

This is an indigenous species found in the northern parts of Australia. It has stood the dry conditions at Cowra and Bathurst exceptionally well, making good growth and remaining green when other native grasses exhibited signs of browning off.

Botanical Description.- A tall glabrous perennial, with erect stems thickened at the joints. Leaves long, linear, acuminate; ligule, short and jagged. Panicle rather narrow, but loose; the lower branches in clusters, the upper usually solitary. Spikelets in sessile clusters or short spikes, outer glumes acute, less than half the length of the spikelet; second and third glumes about equal, prominently nerved, the latter enclosing a male flower; fruting glume coriaceous, acute, smooth and shining.

This grass has an exceptionally vigorous rooting system, forming strong rhizomes from which it sends up succulent foliage, and later cane-like seed-stems. Its rooting system enables it to spread rapidly, and also to withstand heavy feeding and dry conditions. It gives indications of being one of the most promising grasses we have experimented with for some years, and further trials in western districts will be carried out this coming season. The grass is a summer grower, and is cut back by heavy frosts. It seeds freely, and the seed germinates rapidly under favourable conditions of warmth and moisture.

Sheep and cattle eat it readily during all stages of its growth.

Panicum antidotale is common all over the plains of India.

Kokoma Grass, *Rottboellia exaltata*, Linn.

This is one of the most rapid growing annual grasses ever seen in this State. In five months it attained a height of 11 feet under favourable conditions of soil and moisture.

Botanical description.—Roots strong, fibrous; stems slightly compressed, 8 to 13 feet high. Leaves numerous, up to 2 feet long, and ½ to nearly 1 inch broad; hairy on the inner side, margins hispid; sheaths very hairy, hairs stiff and swollen at the base. Spikes about 6 inches long; cylindrical, usually solitary.

Kokoma grass is much coarser than Sudan grass in stem and leaf. It forms a plentiful supply of seed, which germinates readily. It should prove useful in damp situations, where other grasses will not flourish. It is a summer grower and common in Northern Australia.

On the left—Kokoma Grass. On the right—Kolhapur Grass (note the second growth in the foreground).

In Rhodesia, Kokoma grass is considered to be a promising annual for hay, silage or green soiling, withstanding drought well.

Kolhapur Grass, *Andropogon purpureo-sericeus* Hochst.

This is a tall and rapid-growing species of Blue grass that should prove useful in the drier portions of the State. Its growth is nearly as profuse as that of Sudan, stooling capacity and stem and leaf growth being somewhat similar to that well-known grass.

Kolhapur grass is an annual and a very prolific seeder; the seed germinates readily.

Botanical description.—Stems 3 to 6 feet in height, nodes white and hairy. Leaf sheath 4 to 5 inches long, hairy; leaf blade about 8 inches long, with prominent midrib. Inflorescence paniculate, branches capillary, smooth, spikelets in 3 to 4 triplets, one sessile and two pedicellate; sessile spikelet, one flowered. First and second glumes having stiff reddish hairs on dorsum. Flowering glume hyaline, bearing generally from dorsum a long, bent, yellow or red awn.

As the result of a number of experiments conducted by the Agricultural Department in Bombay, India, from which source our seed was obtained, it has been established that the grass is suitable for poor land. On the vast area of poor land of the Bombay Deccan, it suppresses *Andropogon contortus*, which is a dominant but inferior grass. *Andropogon purpureo-sericeus* resists drought conditions to a great extent, acts as a nurse crop to perennial grasses, and is a pioneer grass in the artificial re-seeding of grazing areas.

Rhodesian Buffel Grass, *Panicum maximum.*

This grass was found growing wild in Rhodesia, and on specimens being submitted by the Rhodesian Botanist to the Kew Herbarium, it was classified as a type of Guinea grass. In New South Wales it has given excellent results during the recent dry weather, and at Glen Innes, when most summer grasses had dried off in the grass seed reserves, Rhodesian Buffel was over 3 feet in height, and produced a good quantity of seed.

Botanical description.—A perennial with tall stems, leaves fairly broad, flat, acuminate; sheaths and nodes very hairy. Panicle large and loose, with numerous capillary much-divided branches. Spikelets on filiform pedicels. Lower outer glume one-fourth the length of the spikelet, ovate, obtuse, the third glume enclosing a male flower, outer glumes very hairy; fruiting glume acute, slightly rugose.

This grass is finer in leaf and stem than Guinea grass, and yields a large quantity of fodder per acre. Our supply of seed of this grass was obtained from the Department of Agriculture, Salisbury, Rhodesia.

Buffel Grass, *Pennisetum cenchroides* Rich

This grass has given good results wherever tried, and although not a tall grower, produces succulent feed rapidly. It should prove useful in fairly dry localities, especially where the soil is inclined to be of a light sandy nature.

Botanical description.—A tufted perennial, with many stems, herbaceous, often decumbent, becoming much elongated when growing among bushes. Leaves narrowly linear-acuminate; sheaths smooth or hairy. Spikes cylindrical, dense; rachis rough. Bristles of the sessile involucre numerous, unequal, reddish violet, rarely white: inner bristles widening towards the connate base, plumose, one and a half times longer than the spikelet. Spikelets in pairs, rarely solitary.

Pennisetum cenchroides is common all over the plains of North-west India and in parts of South Africa, and is considered to be an excellent fodder for all classes of stock. It is a summer grower, and forms a plentiful supply of good quality seed, which germinates readily. Our original supply of see was received from the Department of Agriculture, Pretoria, South Africa.

Rhodesian Buffel Grass (*Panicum maximum*).

False Brome Grass, *Brachypodium pinnatum* Beauv.

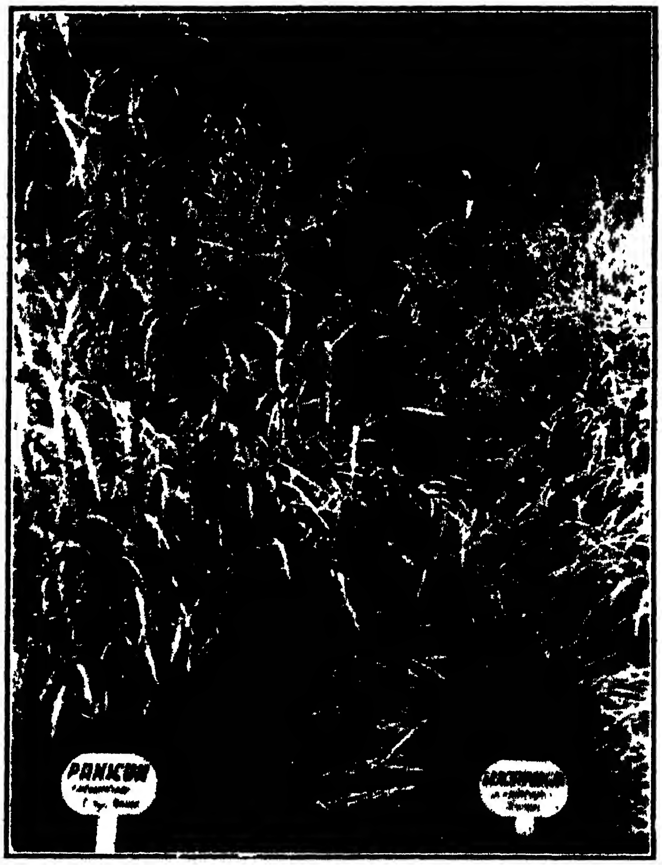
This is a promising winter grass, which also produces good growth during all months of the year. It has an exceptionally strong, creeping root-system, which rapidly covers the intervening spaces between rows or clumps of the grass. The average height of the clumps is about 18 inches.

Botanical description.—Stems 1 to 3 feet long. very slender, terete and smooth. Leaves rigid, almost glabrous, involute, rarely flat, ligule ciliate. Spike 1 to 6 inches; rachis flattened, smooth. Spikelets ¾ to 1½ inches, erect, curved away from rachis, glabrous or pubescent, green and purplish; empty glumes cuspidate, strongly 3 to 5 nerved, flowering glumes 8 to 10, ¼ inch long, with tips suddenly contracted into a short awn.

False Brome grass has proved its usefulness as a frost-resister in trials conducted in coastal districts, and on the tablelands. It should prove a valuable addition to our winter grasses, which, unfortunately, are altogether too few. It produces a good quantity of seed. Our original supply came from California.

Slender Brome Grass, *Bromus marginatus* Nees.

This plant closely resembles Prairie grass (*Bromus unioloides* H. B. and K.) in habit of growth, but being decidedly perennial, and producing a greater bulk of feed, promises to be even more valuable than that well-known species.



On the left *Panicum antidotale.* On the right—False Brome Grass (*Brachypodium pinnatum*

Prairie exhibits a tendency to decrease in growth during the hot months of the year, whereas *Bromus marginatus* remains green and produces feed right through the year, giving the best results, however, during the autumn and winter months.

Botanical description.—An erect, tufted, perennial; leaves and sheaths somewhat hairy. Panicle erect, rather narrow; spikelets oblong, lanceolate, compressed, convex, pubescent-scabrid, 6 to 8 flowered. Inner glumes 7-nerved, awned.

Slender Brome grass seeds freely. Our original supply of seed came from California.

Hickory King Maize Contest.

Entries are invited from farmers who grow Hickory King maize for a "yield contest" on similar lines to those of the contest that attracted so much attention among maize-growers last season. The conditions will be as follows:—

1. The contest is designed to be a test for the best yielding strain of Hickory King seed maize in the State.
2. Each competitor should send ten (10) pounds of his competing seed to the Under Secretary, Department of Agriculture, Sydney, before 31st August, 1923.
3. Three farms will be selected on the coast with as uniform land as possible (one each on North, Central, and South Coast), on each of which a plot of the competitor's maize will be sown under identical conditions; the field will be given the same cultivation treatment throughout.
4. The Department reserves the right to exclude any entry which does not conform to the standard type and purity of seed.
5. After harvesting and weighing the maize, the produce will remain the property of the farmer on whose land the test was conducted.
6. Fertiliser may be used at the option of the farmer on whose land the test is made, in which case the amount used will be the same on each plot.
7. When the crop is ready to harvest, an equal area of each plot will be pulled, husked, shelled, and weighed, and the best yielding strain of seed will be determined by that seed showing the best average yield on the three farms on which the test is conducted.

Messrs. Clifford Love & Co., Ltd., Sydney, manufacturers of cornflour (for which foodstuff Hickory King maize is most suitable), have donated £10 10s. to be used as prizes in the contest. Out of the money £2 2s. will be awarded for the winning seed on each of the three farms, and the balance will be divided into a first prize of £3 3s., and a second prize of £1 1s. for the seed yielding the best average on the three farms.

A Reminder to the Wheat Grower

The past season having been too dry for the germination, and therefore for the destruction of black oats, the familiar pest will probably be present in wheat crops (in the southern district at least) in considerable quantities this year. It is as well to remember that an excellent way to clean up a particularly dirty patch is to cut the crop early, before the black oat seeds have formed, and to turn the growth into silage as an insurance against sheep losses in the next dry spell. All wheat farmers must of necessity keep sheep, and the need for fodder of some nature is certain to arise sooner or later. When fodder is conserved in this form it is secure from weather and vermin, and will retain all its properties for a number of years. The Department issues free descriptive pamphlets on the making of silage, and will supplement the information contained therein wherever desired.—L. S. Harrison, Senior Agricultural Instructor.

An Improved Score Card for Judging Maize Ears.

H. WENHOLZ, Special Agricultural Instructor.

MANY score cards have been evolved for judging maize ears at agricultural shows, and many attempts have been made to correlate some visible characters with yielding capacity so that they can be emphasised on the score card. To do this with any decisiveness and certainty is a difficult matter, but it is certain that in the past too much emphasis has been placed on characters which are easily visible in the ear but which have little or no relation to yield.

The following score card is put forward as an improvement on any previous allotment of points, in that it gives less prominence to many characters which are undoubtedly aesthetic or fancy points, and more prominence to the characters which should be borne in mind in the practical operation of selecting seed maize on the farm.

It will be seen that size and weight of ears and actual condition of the seed are given at least half the points, and with trueness to type and uniformity constitute by far the most important factors in selecting seed. Other visible ear and grain characters, some of which improve the appearance of an exhibit for show purposes, cannot be said to have very much effect on yield.

1. Size and weight of ears	20
2. Seed condition—	
(*a*) Dryness	10
(*b*) Plumpness	10
(*c*) Soundness	10
3. Trueness to variety type and uniformity—	
(*a*) Ears—size, shape, colour of core	15
(*b*) Grain—size, shape, dent and colour	15
Other ear characters (shape, arrangement of rows, butts and tips, space between rows and grain)	10
5. Other grain characters (depth, thickness, colour)	10
Total	100

Other things being equal, the size and weight (dry weight) of the ear are rather important. Almost generally it will be found that an ear which is heavy when dry, especially for its size, will have good solid heavy grain, and this is what it is desired to reproduce. Dryness of seed usually indicates safe storage, good vitality, and strong germination.

The sturdiness of the young plants (which considerably affects the final yield) is determined largely by the plumpness and development of the seed. Soundness means freedom from insect or other injury and disease.

Selected seed must be true to the variety type it is supposed to represent, and should have a large measure of uniformity, which is an indication of care in selection.

If ears have the foregoing qualities, other characters such as shape, arrangement of rows, filling of butts and tips, and space between rows and grain are not especially important, except from the aesthetic standpoint. Similarly if an ear has weight, with solid plump grain, it has most of the desirable grain characters. Very deep soft starchy grain of poor colour and low weight does not constitute good seed maize.

The above score card will no doubt be welcomed as an improvement on existing systems of judging maize in the ear, and is being recommended to the Royal Agricultural Society for judging their Maize Championship class. Other agricultural societies and judges might well follow the lead thus given.

A Farmer's Experience with Elephant Grass.

Writing with regard to a plot of Elephant grass planted two or three seasons ago, Mr. H. A. D. Crossland, "Homewood," Quirindi, on 12th June, 1923, stated that though the past season had been extremely dry the grass had made a very favourable growth, and appeared to thrive well even when heavily fed off. Since the beginning of April it had been irrigated and had made phenomenal growth—up to 6 inches in twenty-four hours. There was no other greenstuff, and milking cows were grazed on it every second night, nipping the shoots right down. In the colder weather the growth was much slower, but whenever there were two or three warm days and nights it revived, and at the time of writing it was still sending up green shoots, though making very little growth. Under irrigation it appeared to produce more milk and butter as green feed than any crop Mr. Crossland knew of, so long as it was not allowed to make a rank growth. In the warm weather, under irrigation or favourable seasonal conditions, it could be relied on to produce 2 feet of growth in a week, and every week, though the second week's growth would be a little slower. If allowed to get rank and then fed off, stock left the butts about 4 feet high. The side shoots from such stalks made excellent feed, but it was wasteful to allow the stalks to grow very long in the first place.

In forwarding the above matter, Mr. J. N. Whittet, Agrostologist, remarked that the Department recommends feeding off or cutting Elephant grass when it is from 2 to 3 feet high. It is a mistake to allow it to make maximum growth before using it.

Silo Facts for the Dairy-farmer.

The height of an overhead silo should be twice its diameter at least; if it is a little deeper all the better, as there will be exerted on the contents of the silo a proportionately greater pressure. A depth of not less than 2 inches of fodder should be removed at each daily feeding. The daily ration of silage required by a cow is 35 to 40 lb., and if it is necessary to store a greater quantity than 150 tons a second silo should be constructed. The cost of building a silo depends upon the materials used in its construction and upon local conditions.

Timber silos cost from 30s. to 40s. per ton capacity.

Concrete block silos, from 40s. to 60s. per ton capacity.

Reinforced concrete silos, from 60s. to 80s. per ton capacity.

—A. Brooks, Works Overseer.

Field Trial with Feterita Grain Sorghum.

COONAMBLE EXPERIMENT FARM.

F. MATTHEWS, Assistant Experimentalist.

ONE of the most successful of this year's summer crops grown under irrigation at the above farm was the five-acre plot of Feterita. It showed decided superiority over maize as a grain producer in the western districts, being unaffected by the dry winds which prove so detrimental to maize at the tasseling stage, and proving also its ability to stand up for longer periods against dry spells.

The soil was of the typical black class. The land was ploughed late in August, the ploughing being followed immediately by a harrowing. Sowing was carried out during the last week in October. One section was sown with a wheat drill, with openings 3 feet 6 inches apart, planting approximately 5 lb. of seed per acre; the second section was sown with a maize dropper with 3 foot drills, sowing 3 lb. per acre. It was noteworthy that the seed sown with the dropper germinated the better, owing, it seems, to better compaction of soil round the seeds by the dropper wheels. The final results showed that sowing at the rate of 3 lb. per acre resulted in a stand which was a trifle thick, and that a sowing at the rate of $2\frac{1}{2}$ lb. per acre would have been ample for a good yield of grain.

The seed bed was dry and watering did not take place until a week later; this practice ensures a better germination than to water first. Feterita seed will germinate well even after flooding, whereas with maize a satisfactory germination is only assured when the water has soaked out from the furrows and not flooded over the seed. Waterings, the equivalent of approximately 4 inches of rain per watering, were given on 1st and 2nd November, 15th and 16th January, and between 20th and 22nd February. We have found that to ensure a good setting of seed the last watering should be given just prior to the flowering stage. Subsequent applications have a tendency to cause suckering and uneven ripening of the crop. A fall of 375 points of rain during the second and third weeks of December, as well as other minor falls, materially assisted the crop.

Harvesting was carried out by hand, the stalks being cut off with secateurs or knives close to the head. Threshing was satisfactorily effected by driving a harvester from the beaters, a pulley being attached to the beater shaft. The heads which were shovelled into the beaters were a trifle tough to thresh, and a small percentage of seed was lost with the stalks, but the saving in time and labour over the old hackler method more than compensated this loss. It was estimated that 100 bushels could be threshed and bagged in a day.

For record purposes the seed off an acre block was kept separate, and after threshing a yield of 40 bushels per acre was obtained. This did not include a percentage of green heads which had not been harvested, having been eaten off by stock.

Feeding trials were carried out with both horses and sheep, and in both cases all the grain was quickly cleared up. Although grown primarily for the grain, it has been found that the plants themselves are also liked by stock, there being scarcely a vestige of the crop left after a few weeks' feeding.

A maize experiment of 22 acres, consisting of both early and midsummer sowings and including eleven different varieties, turned out an absolute failure, although it received, if anything, preferential treatment with regard to watering.

This is the third year that Feterita grain sorghum has been tried on the farm, and the results show that it should be a valuable adjunct to the crops that will thrive and give payable yields under irrigation in the western districts.

The Food Value of Lucerne Threshings.

A sample of lucerne threshings was recently submitted to the Department from the Tamworth district, for report as to its food value. The following table shows the result of this analysis (calculated to moisture-free substance) in comparison with that of lucerne hay:—

	Lucerne Threshings.	Lucerne Hay.
	per cent.	per cent.
Albumenoids	12·19	15·9
Ether extract ...	4·01	3·8
Ash ...	10·56	9·3
Fibre	30·54	32·0
Carbohydrates	42·70	39·0

It will be seen that the threshings were somewhat lower in albumenoids and slightly higher in carbohydrates than lucerne hay. Such material could be used to replace lucerne hay in any feeding ration.—A. A. Ramsay, Chemist.

A Farmer's Experience with Fitzroy Maize.

Details of a test of Fitzroy maize were supplied to the Department recently by Mr. F. J. D. Doust, of Lynn Farm, Camden. The maize was planted on 2nd October on black soil flats on ground that had been twice ploughed, special maize fertiliser being applied at the rate of 1 cwt. per acre. The rainfall over the growing period was 455 points (October, 100 points; November, 165; December, 10; January, 105; February, 75). As the crop was being saved for seed, it was not immediately thrashed, but the yield was estimated at 45 bushels per acre. The variety appealed to Mr. Doust as "a great cow feed or ensilage sort." A number of stalks measured over 9 feet 6 inches, a height exceeded in the tall corn class at the local show only by half an inch and by an irrigated crop. The Fitzroy was one of the very few local maize crops to stand up to the adverse season.

Boys' Sorghum-growing Competition at Bolong.

R. N. MAKIN, Senior Agricultural Instructor.

DURING the past season the Bolong branch of the Agricultural Bureau conducted a sorghum-growing competition among the sons of farmers who were members of the branch. The object of the competition was to ascertain what amount of green feed might be grown per acre under the methods in vogue in the district. The rules governing the competition provided that at least half an acre should be grown, and all particulars in regard to sowing, manuring, and cultivation were to be recorded. The crop was to be judged for yield per acre of greenstuff, cultivation, freedom from disease, &c., and a prize was offered for the best result. There were nine entries, but owing to the dry weather which prevailed five competitors withdrew, as they considered their plots were not up to the competition standard. The remaining four plots were judged during the month of May.

Dairy-farmers have placed great value on green sorghum for dairy stock for late autumn and early winter feed, but of late years, on account of the ravages of the red-stain disease, many have given up growing it. For several years Saccaline resisted the trouble, but it now appears to be as susceptible as other varieties of sorghum. The four plots judged were sown to Saccaline, which at the time of harvesting were singularly free from disease—due perhaps to the dry conditions.

The returns were exceedingly good considering the season. The farms are all situated on soil of alluvial formation, and three of the plots had previously grown crops, F. Hall's being on ground which had not been cropped for eight or nine years. Milton Knapp's plot was sown by drilling the seed in with the wheat drill, sowing through every cup. This plot and F. Hall's were both excellent, and were very close as regards yield. The sorghum in the latter case was not so sweet as on the drilled plot, and there is no doubt the drilling was conducive to a higher concentration of sugar.

The plots were a good lot, and reflected credit on the boys who tended them.

DETAILS OF CROPS.

	M Knapp.	F. Hall.	F. Hanigan.	A. Oke.
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Yield per acre ...	38 17 0 16	38 5 2 24	29 5 2 24	23 0 0 0
Sown ...	Dec., 1922 ...	Dec., 1922 ...	1st Dec., 1922	6th Dec., 1922
Harvested	7th May, 1923	10th May, 1923	7th May, 1923	7th May, 1923
How sown	Drills, 7½ in. ..	Broadcast ...	Broadcast ...	Broadcast.
Seed per acre ..	40 lb.	75 lb.	80 lb.	80 lb.
Manure per acre ...	Blood and Bone 1 cwt.	Nil	Nil	Superphosphate 1 cwt.
Previous crop ..	Maize	Nil	Saccaline ...	Oats.

POINTS AWARDED.

	Maximum.	M. Knapp.	F. Hall.	F. Hanigan.	A. Oke.
	points.	points.	points.	points.	points.
Yield per acre	40	38½	38	29	23
Cultivation	5	5	5	5	4
Freedom from disease	10	8	7	7	7
Palatability	20	20	18	18	19
Leaf growth	10	9	9	8	8
Quality of stems	15	14	13	13	13
Totals	100	94½	90	80	74

"The Diseases of Farm Animals in New Zealand."

This book is one of the best attempts yet seen at placing before the stock-owner the diseases of live-stock found in his own country in such a manner as may be understood by any man with a good knowledge of live-stock and the elements of veterinary science.

Lieut.-Colonel Reid, F.R.C.V.S., &c., is to be congratulated on his work. Although couched in simple language, the book is scientifically accurate, and is brought well up to date. Unlike most books allegedly written for the farmer and stockowner, the book does not contain a long list of fearsome prescriptions built up on the hit-or-miss principle.

Owing to the difference in the conditions of the two countries, the work would not be of the same value to the Australian farmer as to his New Zealand confrere, but would be superior to English or American text-books of the same type as a guide to the Australian stockowner.

Notwithstanding the clarity of the descriptions given and the soundness of the teaching, if this book is to be intelligently used it requires of the reader (in common with other works of the kind), a fair knowledge of the basic sciences, and a capacity in diagnosis not often met with. It is a book thoroughly to be recommended.

Our copy from the publishers, Whitcombe and Tombs, Limited, New Zealand and Melbourne.—M. Henry.

"It's Good Enough."

"It's good enough," was the general remark of suppliers of a small New South Wales cheese factory some time ago to the factory manager when he remonstrated with them for not taking sufficient care of their milk. And so things went on in this "good enough" way—until pay day. Then the returns for the cheese were found to be not nearly so good as they should have been. The dissatisfaction of the community was general, and many nasty remarks were passed with regard to the ability of the cheese-maker. But he was a wise old man, having dealt with this type of dairy-farmer before, and their remarks worried him not a bit. To all who commented on the low returns his reply was: "From the best milk only can one expect the best cheese, and for the best cheese only can the best price be paid."

These farmers learned at a cost of 10 per cent. of their monthly milk cheques that milk, like all other things, is "good enough" only when it is the best.—L. T. MacInnes, Dairy Expert.

Pasteurisation of Milk for Cheddar Cheese-making.

THE BACTERIOLOGICAL ASPECT.

J. K. MURRAY, Lecturer in Bacteriology, Hawkesbury Agricultural College.*

PASTEURISATION has for its object the killing of the great majority of the bacteria present in the raw milk, thus presenting a relatively germ-free milk for inoculation (by starter) with those bacteria which experience has shown to produce good quality in cheese. As indicated in a previous article in the *Agricultural Gazette*, December, 1922, the alternative is a much improved bacterial quality of the raw milk. Careful observance of the factors necessary for such an improvement is uncommon under present Australian conditions, and to bring about their common observance would need years of educational work among farmers as well as regulatory action under a Dairy or other Act. With average milk now reaching cheese factories, "fast" batches and great losses by spoilage are commonplace in cheese made from raw milk. Pasteurisation prevents these conditions by killing out the vast majority of the *Streptococcus lactis* group which are mainly responsible for "fast" batches and members of the *B. coli-ærogenes* group which cause most spoilage. Inoculation of the pasteurised milk with a good quality starter places subsequent fermentations under the control of the cheese-maker. The problem is more complex than that associated with butter-making because of the critical nature of casein coagulation by rennet in the cheese-making process. This coagulating property of casein is affected by heating, and the ability of the coagulum to shrink and expel whey is also adversely affected by the degree of heat used in pasteurisation. Whereas temperatures of 200 deg. Fah. and above have been and are used with success in the flash regenerative pasteurisation of cream for butter-making, experiments elsewhere, and by Mr. T. H. Atkinson in this State, have shown that the most satisfactory temperature for the flash regenerative pasteurisation of milk for cheese-making is, under average factory conditions, about 165 deg. Fah., higher temperatures causing considerable difficulty in the manufacturing process and giving an unsatisfactory product.

College experiments conducted during 1921 with the then Cheese Expert Mr. J. G. McMillan, and during the present year with Mr. Atkinson, have shown that the efficiency of flash methods of pasteurisation at this temperature is satisfactory, both as to the total number and types of bacteria killed.

College Experiments, 1922.

These experiments included trials of pasteurisation by the flash method at 155 deg., 165 deg. and 175 deg. Fah., and the holding process for thirty

* Condensed from paper in the *Journal and Proceedings of the Royal Society of New South Wales*, Vol. LVI, pp. 285–298, 1922. Diagrams now added.

minutes at 145 deg. This latter process was the most efficient in the killing of bacteria (99·94 per cent.); the flash methods at the two higher temperatures were satisfactory, averaging 99·89 per cent.

During the cheese-making process cultures were made from the milk before and after pasteurisation, from the raw and pasteurised milks at renneting, and from the respective wheys five minutes after "cutting" and at "running."

Since the College milk was produced under conditions much superior to those ruling on most dairy farms and was of abnormal richness (being drawn from a Jersey stud), it was blended with farmers' milk.

In the table below the figures represent those obtained from a College series of twelve "raw" and twelve "pasteurised" cheeses manufactured during late May and early June. Each cheese was approximately forty pounds in weight.

The table shows that the bactericidal efficiency of pasteurisation was satisfactory; the average given includes some figures obtained from the flash method at 155 deg. Fah. The reduction in the number of bacteria as a consequence of pasteurisation is marked at all stages of the process. The most significant figures are those giving a comparison of the undesirable micro-organisms (which include the harmful gas-forming bacteria) present in the raw and pasteurised milks at renneting, 109,000 and approximately 3,000 respectively.

BACTERIAL counts obtained at Hawkesbury Agricultural College

Period in cheese-making process	Average count per c.c.		Maximum count per c.c.		Minimum count per c.c.	
	Raw.	Pasteuris'd	Raw.	Pasteuris'd.	Raw	Pasteuri'd.
Total micro-organisms in the mixed milks	308,000	1,500	617,000	11,150	16,000	132
Undesirable micro-organisms in the mixed milks at renneting	**109,000**	**2,750**	268,000	6,000	21,000	less than 100
Undesirable micro-organisms in wheys at "cutting"	**113,000**	**2,080**	394,000	10,500	4,800	ditto
Undesirable micro-organisms in wheys at "running".....	28,000	1,400	72,000	3,200	3,300	ditto
Micro-organisms other than *Sc. lactis*, in one day old cheese	*927,000	*136,000	*3,500,000	*750,000	35,000	less than 1,000

* Per gramme.

Moruya Experiments.

By courtesy of the directors the experiments were continued at the Moruya Co-operative Cheese Factory, where the quantity of milk used was much greater, the daily total varying from 4,480 to 5,530 lb. Cheese was made

from the raw and pasteurised milks, the former serving as a check. Each batch was controlled in the way calculated to give the most satisfactory product. Vats and other conditions in common were alternately used for raw and pasteurised batches. The temperature at which the regenerative pasteuriser was run had extreme variations of 161 and 170 deg Fah., but did not remain more than a degree from 165 for a longer period than one minute except in the case of the first batch.

Owing to flood conditions occurring during the experiment, some of the milk came in somewhat stale, and the chemical and physical nature of the milk solids may have been affected by the hard conditions experienced by the cattle.

Transport over rough roads by service car caused some petri dish cultures to be damaged and the records given in the following tables are not complete.

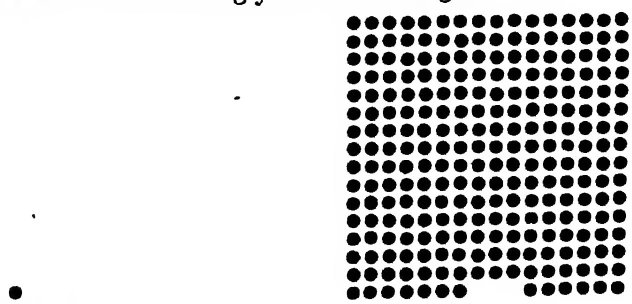
Pasteurised and Raw Milk Compared.

To obtain a better comparison with "raw" vat conditions, the samples of pasteurised milk were taken from the bulk after its passage over the cooler; the actual efficiency of the pasteuriser would then be somewhat higher than the percentage (99·6) calculated from the figures. Cooling to renneting temperature is an essential part of the process, and contamination during cooling is legitimately recorded against the pasteurisation process

TOTAL micro-organisms present in the raw and pasteurised mixed milks at Moruya Co-operative Cheese Factory.

Day of Manufacture.	Raw Milk.	Pasteurised Milk.
	per c.c.	per c.c.
First day	610,000	875
Second ,,	654,000	512
Third ,,	1,280,000	4,080
Fourth ,,	612,000	500
Fifth ,,	206,000	7,220
Average	672,400	2,650

These figures are more strikingly shown in Diagram No. 1.



Pasteurised Milk. (1 Bacterial cell) **Raw Milk.** (253 Bacterial cells.)

Diagram No. 1.—Comparative Numbers of Bacteria in Pasteurised and Raw Milk. Each dot represents a bacterial cell.

The Milks Compared at Renneting.

One of the beneficial influences of the pasteurisation process in cheese-making lies in the comparatively clear field left for desirable bacteria in the processed milk. These bacteria greatly predominate in the milk at the time of coagulation owing to the addition of starter to this cleared field.

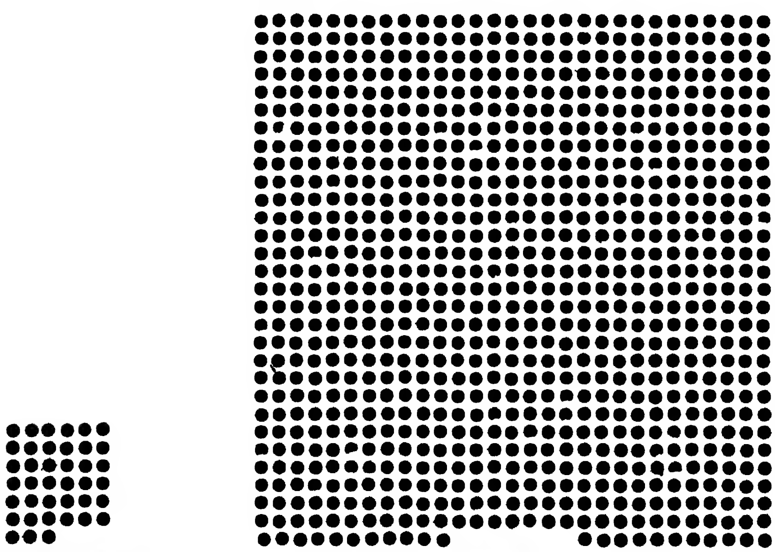
Once the coagulum has been formed it is, of course, difficult to introduce any new bacterial type, and little control can be exercised over the relative activities of the contained bacteria during stirring, cheddaring, salting, and pressing. Hence the essential nature of a pronounced predominance of desirable types of bacteria at the time of coagulation.

UNDESIRABLE micro-organisms present in milk at time of renneting.

Day of Manufacture.	Raw Milk.	Pasteurised Milk.
	per c.c.	per c.c.
First day	700,000	5,000
Second ,, ...	212,500	6,000
Third ,, ...	1,515,000	130,000
Fourth ,, ...	*	252,000†
Fifth ,, ...	1,025,000	14,000
Average ..	863,125	39,000

* Petri dishes broken in transit. † Not included in average.

The comparative freedom from competition enjoyed by the starter organisms is made clearer by Diagram No. 2.



Pasteurised Milk. (39 Bacterial cells.) **Raw Milk.** (863 Bacterial cells.)

Diagram No. 2.—Pasteurised and Raw Milk at Renneting.
Each dot represents a microbial competitor with the starter organisms at renneting.

Pasteurisation has the other great advantage that milks which would ordinarily give rise to fast-working batches, owing to the rapid production of lactic acid by the high number of contained organisms, are brought under control by the killing of the vast majority of these and their replacement by the bacteria in an amount of starter calculated to give a normally-working, easily-controlled batch.

The high counts of the pasteurised milk on the third and fourth days were probably due to much dirtier conditions of milking arising from flood conditions.

Wheys at the time of Cutting the Curd.

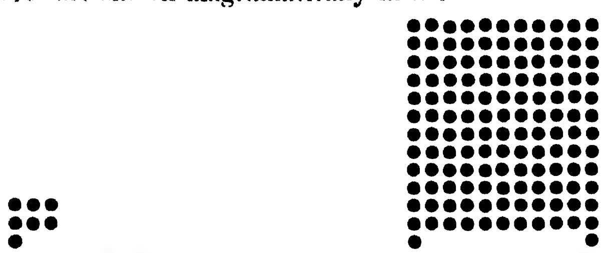
The following table presents the respective figures for the raw and "pasteurised" wheys at the time of cutting the curd.

UNDESIRABLE micro-organisms present in whey immediately after "cutting."

Day of Manufacture.	Raw Whey.	Pasteurised Whey.
	per c.c.	per c.c.
First day	65,000	3,200
Second "	136,000	450
Third "	175,000	15,000
Fourth " .. .	*	*
Fifth "	146,000	8,500
Average ...	130,000	6,800

* Petri dish cultures damaged.

These figures are shown diagramatically in No. 3.



Whey from Pasteurised Milk. (7 cells.)

Whey from Raw Milk. (134 cells.)

Diagram No. 3.—Wheys from Pasteurised and Raw Milk Compared.
Each dot represents a microbial cell mostly of an undesirable type, present in the whey five minutes after cutting the curd.

When cut, the curd surfaces liberate a small proportion of fat globules, curd particles and bacteria in the fast escaping and accumulating whey. While the constantly-increasing volume of the whey as the result of curd shrinkage makes bacterial counts only an index to numbers contained in the curd particles, the relative proportions of contained bacterial groups is probably similar in curd and whey at this stage.

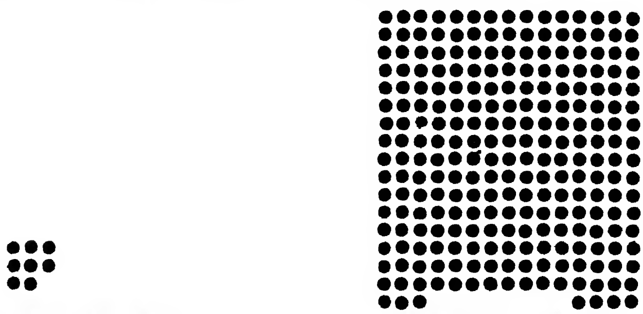
The respective averages of 130,000 and about 7,000 per c.c. of undesirable bacteria in the wheys from raw and pasteurised milk are striking.

UNDESIRABLE micro-organisms present in whey at the time of "running" or "wheying off."

Day of Manufacture	Raw Whey	Pasteurised Whey
	per c.c.	per c.c.
First Day	54,500	10,900
Second ,, ..	680,000	3,500
Third ,, ..	108,000	15,000
Fourth ,, .	85,000	500
Fifth ,, .	*	2,500†
Average .	231,800	7,500

* Cultures damaged † Omitted from average

These figures are shown diagrammatically in No. 4.



Whey from Pasteurised Milk at "running." (8 cells.)

Whey from Raw Milk at "running." (247 cells

Diagram No. 4.—Wheys at time of "running"

Each dot represents a microbial cell, mostly of an undesirable type, at the time of running the whey

At wheying-off the contrast between the numbers of undesirable bacteria in the two types of whey is even more marked than at cutting. In this connection it should be borne in mind that both wheys are exposed to contamination from air, hands, mechanical stirrers, &c., which would be expected to increase their content of undesirable bacterial types.

This contamination and the different physical and chemical conditions which have been gradually taking place in the whey and curd since the time of cutting, make the bacterial count of a whey at wheying-off a less reliable indication of the prevailing curd content of bacteria both as to number and as to the relative proportions of groups than at cutting. Nevertheless, the marked contrast between the "raw" and "pasteurised" figures confirms the allowable deduction at the time of cutting that the condition of the "pasteurised" curd as regards bacteria is much superior to that of the "raw."

These figures, coupled with those obtained at renneting and cutting, demonstrate that the curd made from pasteurised milk is remarkably free from undesirable bacteria. It is probable also that in killing the bacteria, pasteurisation at the same time destroys the master substances within them

(the endo-enzymes) which direct and quicken chemical change. In a cheese made from unpasteurised milk it would appear that the damage done by undesirable bacteria does not cease with their death, which occurs during the process of ripening, and that the endo-enzymes are subsequently set free by the breaking-down of the dead cells.

The first sentence of the preceding paragraph would not hold for milk pasteurised on farms—a practice being mistakenly encouraged by at least one South Coast factory. Admittedly fast batches are thus reduced in number. Farm pasteurisation entails the unevenness associated with as many processes as there are farms. Many milks are overheated with consequent changes in the milk solids, particularly the casein and mineral content, which make for a cheese of unsatisfactory body and texture. Bacterial spores will survive the processes employed, germinate and produce undesirable products; the dangers of recontamination are great. A uniformly high-grade product cannot be produced under such conditions. The practice should be compulsorily replaced by centralised pasteurisation at the factory.

Reinfection of Pasteurised Milk.

P.W. Allen found that pasteurisation caused milk to become more favourable to the attack of gas forming bacteria. While this weakened resistance is probably general for all common forms of milk bacteria, his investigations emphasise the necessity of minimising post-pasteurisation contamination.

Pasteurised milk may be easily reinfected with undesirable bacteria by careless cleaning of the cooler, pipe connections, pump, vats, etc. R. S. Smith, and H. F. Judkins and P. A. Down have drawn attention to the reinfection brought about by coolers. The latter investigators, in working with market milk, found an average increase of 3,664 bacteria per c.c. due to milk passing over a cooler, while a pump and pipe added 11,755 bacteria per c.c.; in this investigation the cooler and pipe line probably received average or better attention. Judkins and Down add that the use of chloride of lime solution in flushing out all equipment before processing milk was found to do away with practically all recontamination of milk after pasteurising.

Counts have been made of the fluid left in the bottom of vats and in the receiving trays under coolers. The lowest number of micro-organisms per c.c. was 563,000 and the highest 3,270,000. With summer conditions prevailing the numbers would be greatly increased and the proportion of harmful bacteria probably higher than in winter.

It is obvious that the benefit of pasteurisation of milk can be lost, and that "pasteurised" cheese may be of lower quality than raw milk cheese if after-contamination is considerable—the result of dirty factory equipment and conditions.

Pasteurisation and the Vitamine Content of Cheese.

Notes on the quality of a dairy product are not complete without information being given as to its vitamine content. Recent research has shown the exceptional nature of milk and many of its products as suppliers of vitamines

in human nutrition. Any process which reduces the vitamine value of a foodstuff is to that extent rendered undesirable. Fortunately, the vitamine content of cheese made from pasteurised milk is not likely to be different in any marked way from that of the raw milk product. Cheese made from raw or pasteurised milk may contain the anti-rachitic and anti-neuritic vitamine, while both are probably devoid of the anti-scorbutic vitamine.

Quality of Pasteurised Cheese.

The following notes kindly supplied by Mr. Atkinson show that an improvement in quality accompanies the improved bacterial conditions :—

"The cheeses were examined by Mr. A. T. R. Brown, a Senior Dairy Instructor of the Department of Agriculture, and Mr. H. Parbery, Manager, Moruya Co-operative Dairy Company. The cheese showed in all cases a marked improvement in flavour without losing in texture or body to any marked extent. It was shown that cheeses could be made from pasteurised milk which were equal in texture and body to those made from raw milk. This confirms for our conditions the experience of New Zealand, where more than 70 per cent. of factories use the pasteurising process. On account of the improved flavour and keeping quality since the installation of the pasteuriser at Moruya, shipping companies are buying this cheese in place of special brands previously called for."

New Zealand experience is conveniently summed up by Mr. C. Stevenson:— "The improvement in the quality of the cheese made from pasteurised milk as compared with that made under the old system has been very marked indeed . . . in most factories where pasteurisation is carried on second grade cheese has been almost entirely eliminated . . . with pasteurisation the milk is in practically the same condition from day to day, and consequently a very much greater degree of uniformity in the quality of the cheese can be obtained."

* * * *

The writer wishes to express his appreciation of the unstinted assistance given by the Manager of the Moruya Co-operative Dairy Company, Mr. H. Parbery, and by Mr. G. MacGillivray, Dairy Instructor, of this College, and the invaluable collaboration of Mr. T. H. Atkinson of the Dairy Branch.

LAND FOR SHARE FARMERS.

WOULD the Department advise him as to the locality likely to offer the best opportunities for wheat farming on shares, wrote a farmer recently. "I am desirous of obtaining a share farm with a residence (cottage) on it. If you are aware where these terms are included, will you please advise me."

The name and address of the writer is obtainable on application. Inquiries of this nature reach the Department with comparative frequency, and landowners who desire to let land on shares are invited to communicate with the Under Secretary, stating the area and the terms on which they are prepared to make the land available.

The Problem of Second-quality Cream.

SCIENCE AS A HELP TO DAIRY-FARMERS.

C. J. MACDERMOTT, H.D.D., Senior Dairy Instructor.*

THE question of dealing with the second-quality cream supplier has been discussed at some length by previous conferences, and has usually received considerable attention. Possibly this particular question was never of greater consequence than it is to-day, on account of the fact that in all dairying countries of the world, and particularly in New South Wales, there is a movement on foot to uplift the quality of the butter manufactured ; and also by reason of the fact that the market for low quality butter is most unsatisfactory. It is not the intention of this paper to discuss the subject of uplifting the quality of the New South Wales butters—a considerable number of factors play a part in such a scheme—but it is hoped to make clear the methods employed by the Dairy Branch of the Department in trying to reduce to a minimum the quantity of second-quality cream delivered to butter factories throughout the State, and to point out how the application of science and scientific investigation can assist towards this end. It is recognised that the second-quality cream supplier has a direct retarding influence on the quality of the New South Wales butter, and is therefore one of the factors which must be considered conjointly with any scheme for quality uplift.

If it were possible to formulate some method of eliminating the second-quality supply the biggest difficulty in uplifting butter quality would have been overcome. Under the existing conditions of dairy-farming in this State it is not possible entirely to eliminate second-quality cream ; but it is, or should be, possible to reduce it to a minimum. This can only be accomplished by the close co-operation of all parties concerned, namely, the dairy-farmer, the factory manager and the Dairy Branch.

How the Department Helps.

Before true progress can commence in this direction, the dairy-farmer must realise that the functions of the Dairy Branch are to assist him to obtain a bigger return for his labour and exertion than is the case at present, and to endeavour to help him to solve some of the problems that crop up from time to time.

The Dairy Branch has adopted the method of individual investigation in dealing with the second-quality cream supplier ; that is to say, each second-quality supplier is interviewed personally, and an endeavour is made, by inspection, to locate the source of the trouble. If this method is to prove successful, there must be complete understanding and harmonious working between the dairy-farmer and the dairy instructor.

* Paper read at the Conference of New South Wales Co-operative Butter and Cheese Factory Managers and Secretaries, June, 1923

Unfortunately, at the present time this condition of things does not exist in every instance, and best results cannot be achieved. In a number of instances second-quality suppliers resent a visit from the dairy instructor, and seem to regard it as a reflection on their efficiency. They lose sight of the fact that a man may be an excellent dairy-farmer and yet not fully understand the different influences which cause deterioration in the quality of a cream. It must be recognised by managers and directorates that the better the feeling existing between the supplier and the instructor the better the opportunity for gaining the desired end.

The general procedure in dealing with a second-quality supplier is as follows:—

The cream on the factory platform is examined and graded by the instructor, and a note made of any peculiarities which may assist him in locating the trouble on the farm. In some cases a very good indication of the cause may be obtained by the flavour or the condition of the cream, as delivered to the factory. It is not possible to state definitely, on the factory platform, that any particular flavour is caused by a certain condition on the farm, but it is of great assistance to grade and examine the cream before proceeding to the farm.

On visiting the farm a general inspection is made of the bails, dairy, all utensils, separator parts, water supply, and, if necessary, the cows themselves. Should this inspection disclose any cause which can be associated with the flavour noted in the cream at the factory, the case can possibly be cleaned up immediately.

In all instances, general suggestions are made to the supplier with reference to milking under clean conditions, and the care of milk and cream on the farm.

The cause of second quality cream is not always apparent to the naked eye and should the case present any difficulties, or the fault be hard to locate a bacteriological examination of the cream is made, which, in most instances, results in the location of the trouble.

Once it has been definitely established that a specific organism, or organisms, are causing the trouble, it is a much easier matter to locate the origin of such contamination, and eliminate the cause, for most bad flavours are biological, and all organisms have more or less prescribed bounds for their habitat. Hence, by the aid of bacteriological examination and visits of inspection, it is hoped gradually to reduce the quantity of second-quality cream.

The Value of Bacteriological Examinations.

Instances of how bacteriological examination of the cream has assisted in locating the cause of deterioration in stubborn cases may be of interest, and the following cases may be taken as typical:—

Example A.—A factory manager submitted a sample of cream from a supplier whose cream had gone back in quality from choicest to second grade.

A bacteriological analysis of this sample showed a very high count of organisms of the *Bacillus coli* group, which are associated with cow manure. This indicated contamination from a dirty cow yard, as dust or mud, or from dirty teats, tail, flanks, or the udder of the cow.

Instructions were given as to how to prevent this contamination taking place, and as a consequence the cream was improved to choicest quality, and maintained at that grade.

Example B.—A fairly large supplier to a certain factory had been troubled with ropy cream for a considerable time. The factory manager concerned got in touch with the dairy instructor, and bacteriological exposures made at the dairy showed that an organism causing a ropy condition in milk and cream was present—(1) In the dust in the cow yard ; (2) on separator parts and utensils ; (3) in lids of cans.

Recommendations as to the best methods of overcoming contamination from the above sources were made, and upon being put into operation the ropiness entirely disappeared.

Many other instances could be quoted to show how scientific investigation has assisted in locating the point of contamination on the farm, but the examples mentioned illustrate how bacteriological investigation can assist in the work of reducing the second-quality cream supply.

The number of bacteriological examinations is at present somewhat limited owing to the fact that all supplies must be obtained from the Biological Branch, Department of Agriculture, and the propagation and identification of types must be also conducted there.

The value of scientific investigation has been apparent for a considerable time, and, realising the benefit to be obtained from it, several factories are arranging for equipped laboratories to be installed for their own use and the use of the instructor in the district. This is a move in the right direction, and the factories concerned are to be complimented on their foresight.

It is to be hoped that factory managers and directorates will give the question of installing bacteriological laboratories the consideration it deserves, and that a laboratory will eventually be established in each sub-district, or on each river.

Where more than one factory is concerned, the expense of installation could be equally divided. It costs, approximately, £100 to equip a bacteriological laboratory for carrying out the work indicated. A list of the appliances and apparatus required may be obtained from the Dairy Branch.

If laboratories could be established at different centres in each dairying district, the bacteriological examination could be undertaken by the dairy instructor, and consequently the work would be decentralised and greatly accelerated.

It might be mentioned here that a laboratory would also be of great assistance to a factory in other ways besides along the lines indicated. With the establishment of bacteriological laboratories at different centres, the first serious step towards reducing the quantity of low-quality cream will have been taken.

The importance of the application of science to practice has been amply illustrated during the development of many industries, and in no case more than in the dairy industry.

The Financial Aspect.

Consider this question of second-quality cream from a "cash value" standpoint, and it will be seen that not only does the individual supplier stand to gain by the uplifting of the quality of his product, but the industry as a whole is directly concerned, and in no small degree. Take the case of the individual supplier first:—

A second-quality supplier, milking forty cows, and supplying, say, 600 lb. of butter a month to the factory, stands to lose £5 a month, allowing 2d. a pound between choicest and second-quality price. A sum of 3s. 4d. a day, or £1 3s. 4d. a week is more than any man can afford to throw away, and even if only a percentage of his supply is second quality, the loss by the end of the year is a considerable item.

A conservative estimate of the amount in £ s. d. lost by low-quality suppliers for the year 1920–1921 is £40,000, this estimate being based on prices paid to suppliers. This amount is a dead loss to the individuals concerned, and has a retarding influence on progress. It is hoped to reduce this amount to an absolute minimum by using scientific investigation along the lines indicated.

The Work of the Dairy Instructor.

An illustration of how this is being done is given by the actual results of investigations carried out in connection with second-quality cream suppliers. A full record was kept of 113 visits made during the season to second-quality suppliers for the purpose of giving instruction in the care of cream on the farm. It shows the following results:—

Number of suppliers whose cream improved to choicest quality, and was maintained at that standard...	80 = 71 per cent.
Number of suppliers whose cream improved temporarily, but went back in quality at a later date	16 = 14 per cent.
Number of suppliers whose cream showed no evident improvement in quality ...	17 = 15 per cent.

These actual results show that the methods employed are bearing fruit and working towards the desired end Seventy-one per cent. of the 113 suppliers visited improved permanently. This must be considered a very satisfactory figure. Fourteen per cent. temporarily improved. This emphasises the statement that the second-quality supplier, up to a certain limit, will always be with us under existing conditions. Although they showed by their improvement in quality for a short time that they were capable of supplying a choicest article, these men failed to maintain the

standard. In the 15 per cent. who showed no improvement there would probably be a percentage who failed to carry out the suggestions made at the time.

As the aid of scientific investigation is gradually made more use of, the question of dealing with the suppliers who improve temporarily, or do not improve at all, will be made easier.

Consider the financial aspects of these visits for a moment. As stated, eighty suppliers improved their supply from second quality to choicest, and maintained the improvement. Assuming that these men were average dairymen, milking forty cows of average production, and that previous to the visits made, the whole supply was second quality, and would have remained so for the season (six months), the improvement in quality means an increased return to each individual of approximately £30 for the season, or a total of £2,400 for the eighty suppliers. Assuming that only half their supply for the season was second quality it means an increased return of over £1,000 for the men concerned. Add to this the additional amount received by the suppliers who temporarily improved, and it will be seen that the question of increased returns is closely linked with that of quality improvement.

The Loss to the Industry.

The industry as a whole is affected to a much larger extent than is generally recognised by the low-quality cream supply. As stated previously, the estimated amount lost by low-grade suppliers for the year 1920–1921 was £40,000, allowing a difference of 2d. per lb. below choicest for second quality, and ½d. per lb. below choicest for first quality. As a matter of fact, the loss to the industry is considerably more than that, as it is generally admitted that the low-quality supplier is actually paid more than his produce returns to the company concerned. This feature has been particularly apparent during the last two months, when low-quality butter has returned about 1s. per lb. to the factory, while the supplier has been paid at the rate of 1s. 4d. to 1s. 8d. Such a condition means that the choicest supplier is carrying the low-quality supplier on his shoulders, which is neither desirable, equitable, nor economical.

Not the least important feature is the fact that the amount of low-quality butter going on the English market influences the price of our choicest butter, and we have to be content to accept 10s. or 12s. a hundredweight less than we actually should.

We know that our best butters compare favourably with New Zealand's best or Danish choicest, and yet there still remains the discrepancy in the price which is attributed, in part, to the amount of low-quality butter put on the market influencing adversely the sale of our choicest article. Other States are probably bigger offenders than we in this respect, but, nevertheless, the fact remains that the industry in this State is losing about £60,000 per annum by this disparity in price alone. It should be recognised that th low-quality cream supply has an indirect, as well as a direct influence on the financial side of the industry.

All concerned can assist in improving existing conditions affecting the cream supply. Directorates can do much by improving transit facilities, establishing cream zones where necessary, encouraging scientific investigation, and by sympathetic assistance generally. With reference to transit arrangements, the aim should be a daily supply. In many factories this is an impossibility at present, but the day is not far distant when such a system will be possible for most factories. This is a tremendous help to the factory, and all transit arrangements should be considered with this ultimate aim. It is a notable feature that where cream zones are established in this State the percentage of second-quality cream delivered is considerably less than where overlapping of cream runs exists.

Managers can assist by strict grading, generally working in conjunction with dairy instructors regarding advice to dairy-farmers, and endeavouring to create a feeling of confidence between the supplier and the instructor. It should be the factory's aim to produce a higher percentage of choicest butter each year. The dairy-farmer must realise that the factory manager and the instructor are out to assist him in producing a higher grade cream. The instructor's visits to the farms are purely for advisory purposes. Whether the advice is acted upon or not rests entirely with the supplier. Some dairy-farmers who do not understand the influences operating in reducing the quality of a cream are inclined to regard the recommendations offered as superfluous or unnecessary, and consequently do not act upon them. It is because of this that it is not possible entirely to eliminate low-quality cream, but much good can yet be done. There are still about 1½ to 2 million gallons of cream under choicest grade being delivered each year to our factories, and it should be possible to improve the majority of this to choicest quality by working along the lines indicated in this paper.

Conclusions.

(1) The value of scientific investigation in locating the cause of inferior cream has been proved beyond doubt.

(2) The work of reducing the amount of low-quality cream can be greatly accelerated by the establishment of bacteriological laboratories in district centres.

(3) The close co-operation of factory directorates, factory managers, and the Dairy Branch of the Department is necessary to attain the desired end.

(4) The supplier must recognise that the factory management and the Dairy Branch are anxious to assist him in producing a higher quality cream.

(5) The production of low-quality cream has both a direct and an indirect influence on the financial aspect of the industry.

(6) The question of better transit and the establishment of cream zones for each factory, where necessary, are factors which must be considered in the question of reducing the quantity of low-quality cream being delivered to the New South Wales factories.

Roughage.

R. H. GENNYS, Artarmon.*

ROUGHAGE is a word with rather a wide range, but it is here used as a term for coarse, bulky, fibrous material of crops which commonly is either burnt off, stacked anyhow, or allowed to rot. A small portion is used in the New England country as bedding for animals, but in such a warm climate as that of the greater portion of Australia it will never be required for that purpose in a large degree. Some, of course, is ploughed in, and serves the useful purpose of adding organic matter to the soil. The stubble, too, is eaten down by sheep, a most proper and profitable way of helping mixed farming, but there has been in good years, and will be as closer settlement increases, a vast amount of roughage which should be used to the best purpose instead of being wasted as at present.

Materials of this kind can be used to furnish ruminants with that abundant chewing stuff which their capacious stomachs demand. In addition, it will provide considerable nutriment when well handled, and can thus be made a valuable stand-by for bad times, helping considerably to make more expensive fodders, such as lucerne and oaten and wheaten hays, go further. Indeed, if dry stock start a winter or harsh period in fair order, they can not only be kept alive on some of the rough fodders now under consideration, with the addition of plenty of water and a good lick, but they will actually improve in condition, the hardship and loss of energy and warmth incurred in walking and searching for food being spared them.

Experience has shown that the best and most economical method for the farmer, and also for the animals themselves, especially if they be dry stock, is to let them pull at stacks of these rough fodders for themselves. It is a pleasure to see cattle in wintry weather and bad times helping themselves to big mouthfuls of dry, warm straw with great relish, and then proceeding to a good lick, and to the tank for a drink, finishing up by chewing their cud in peaceful repose.

By itself straw chaff is of nothing like the same value as the long material, and for very weak stock it is even injurious unless mixed with molasses or soft foods. The feed that fills up the stomach and is in a form which requires much chewing meets half the trouble, being made easily digestible and staving off the pangs of hunger. Wheaten and oaten straw will provide a large quantity of roughage in most years. The trouble is to stack it well so as to throw off rain; good straw-stack builders are most useful men.

Maize Stalks, Stover, &c.

It is common enough to let stock into paddocks of maize-stalks to eat and tread them down at will—generally long after the cobs have matured and

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* Formerly Manager of Glen Innes Experiment Farm.

have been harvested. The stalks are then very dry, almost leafless, uninviting, and not very nutritious, though for filling animals and for chewing material they are much better than nothing. An enormous quantity of food is wasted under such circumstances. Much better is the method that has been practised for several years at Glen Innes Experiment Farm. There the maize stalks are conserved as shredded stover. Stover is cured maize fodder with the cobs removed. Some judgment is required in selecting the time to cut the plants so that the grain may be saved and that the material may dry out like hay, preserving its nutriment and some of the colour in leaf and stalk. The crop should be cut with the ordinary maize harvester at about the hard dough stage of the kernels, and the bundles are built into stooks and left for some weeks until the grain has hardened and the material is dry and fit for stacking. It is then drawn into the maize shredder—which tears up the stalks, leaves, and husks, and delivers them to an elevator, which lifts them on to a stack built like an ordinary straw stack. The machine at the same time husks the cobs, and throws them out by themselves, where they can be shelled for seed or for feed.

Dry dairy cattle in a bad winter actually improved in condition on a stack of this, eating it to the ground. A flock of sheep on one occasion also finished a stack of it, devouring it greedily. Of course, both sheep and cattle will undermine the stack, and it should be trimmed from time to time or protected by hurdling to prevent it toppling over in bulk, which may cause damage to stock or material. The shredded material is capable of being baled by the straw-press and transported anywhere for stock feed in drought.

Maize stalks may be harvested in the same way after the cobs have been removed, and either stacked or taken straight to the cattle from the field.

Besides these straws and cornstalks, there may be grass-hay, pea-straw, soy-bean straw, and other by-products from farm produce, all of which should be saved where possible to fill up during the inevitable lean years.

"Pig Breeders' Annual, 1923"

"There is no golden rule for pig-keeping; success comes from attention to a score of details, and the hopeful feature I see in the situation is the increased interest that is being given to these points of practical management." So says Sir Robert A. Sanders, Minister of Agriculture and Fisheries, in a foreword to the "Pig Breeders' Annual, 1923," published by the National Pig Breeders' Association of England.

In addition to recent statistics of the pig products of the United Kingdom, and the awards at shows in the year 1922, the book contains a series of excellent articles on various aspects of the pig industry, the subjects covered including the breeding, feeding, and health of pigs. It is as true in New South Wales as in Great Britain that (as one of these writers says) "we want more pigs, and those of the right type, in form, weight, and quality; but this remark is a mere platitude if farmers insist in ignoring the facts. The variety bred matters much less than the increase."

Our copy comes to us from the National Pig Breeders' Association, London.

Weeds of New South Wales

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Devil's Claw, ***Proboscidea (Martynia) louisiana*** **(Mill.) Woot. and Standl.**

Botanical Name—Proboscidea.—Latin, *proboscis*, from the appearance of the seed capsule before it opens, which resembles a snout or trunk; hence one of the common names Elephant's Trunk; *louisiana*, of Louisiana, where it was first found.

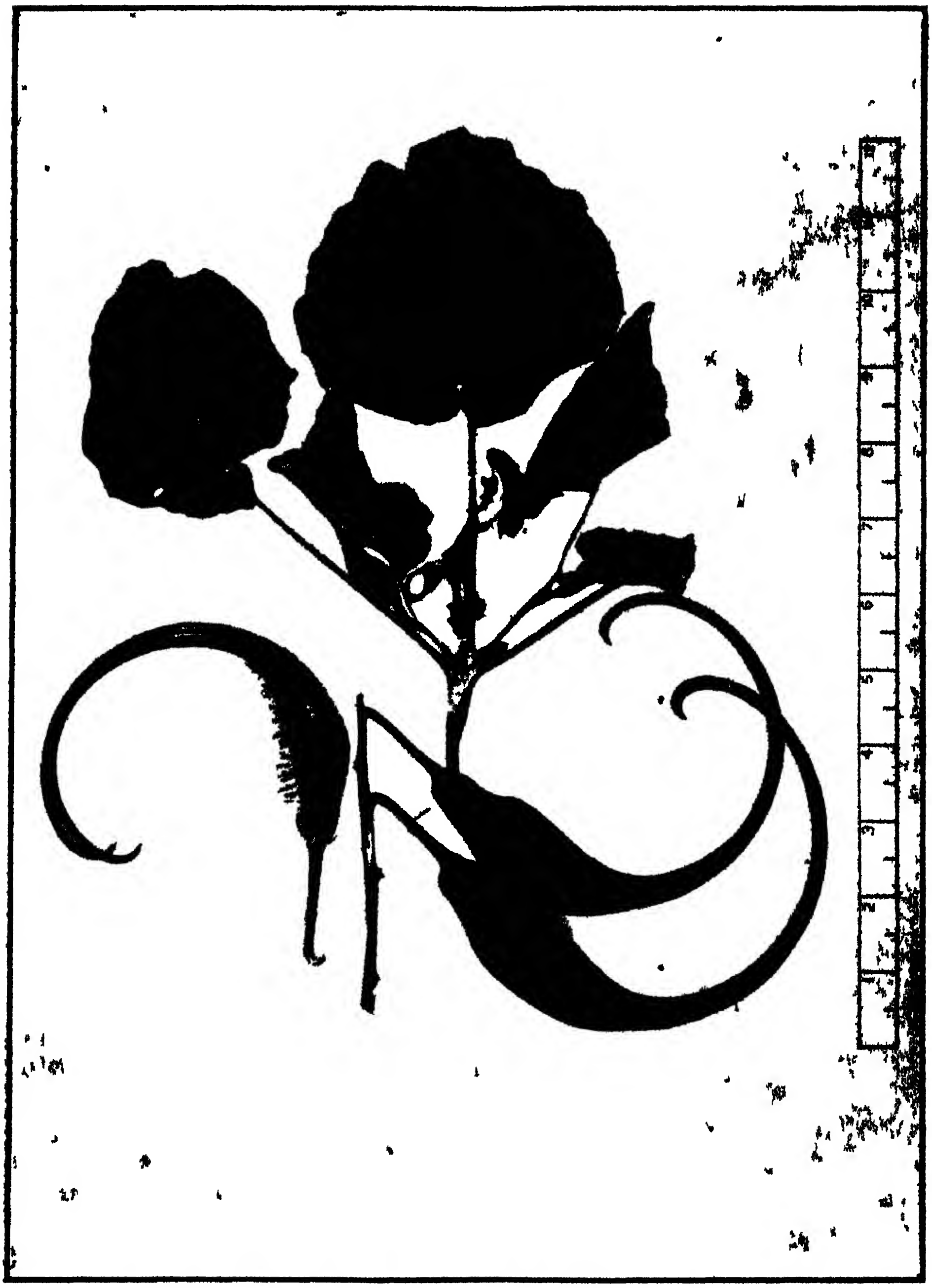
Common Names.—Devil's Claw, Unicorn Plant, Elephant's Trunk, Ram's Horn.

Popular Description.—A soft, pumpkin-like plant with a short, thick, stem and branches, the branches usually spreading along the ground for 1 to 3 feet or more, according to local conditions. Leaves large, roundish to heart shaped, soft and velvety, but cold and clammy to the touch; 3 to 9 inches broad; leaf stalks long. Flowers several together on a spike 3 to 6 inches long, tubular, or somewhat funnel-shaped, yellowish white, variegated with green, pale purple, and violet spots, 1½ to 2 inches long. Ripe seed capsule lead coloured, 4 to 6 inches long, the hard woody base with a row of short spines or bristles along the lower side, and with a few light depressions on both sides near the end, the upper portion terminating in two long claw-like spines. Seeds twenty to forty in the capsule, rough, lead coloured, nearly ½ inch long.

Botanical Description.—Annual, densely grandular-pubescent all over; stem stout, much branched, the branches prostrate or ascending, 1 to 3 feet long. Leaves broadly ovate to orbicular, rounded at the top, cordate at the base, repand, undulate or entire, 3 to 9 inches in diameter or more, the petioes stout, mostly longer than the blade; bractlets at the base of the calyx oblong or linear, deciduous; calyx somewhat cleft on the lower side; raceme several flowered; pedicels slender; corolla whitish or yellowish, mottled with purple or yellow within, 1½ to 2 inches long, the limb nearly as broad, the lobes obtuse; stamens all anther-bearing; fruit strongly curved, 4–6 inches long when mature, the beaks longer than the body, splitting into two elastically diverging segments, the endocarp crested on one side only.

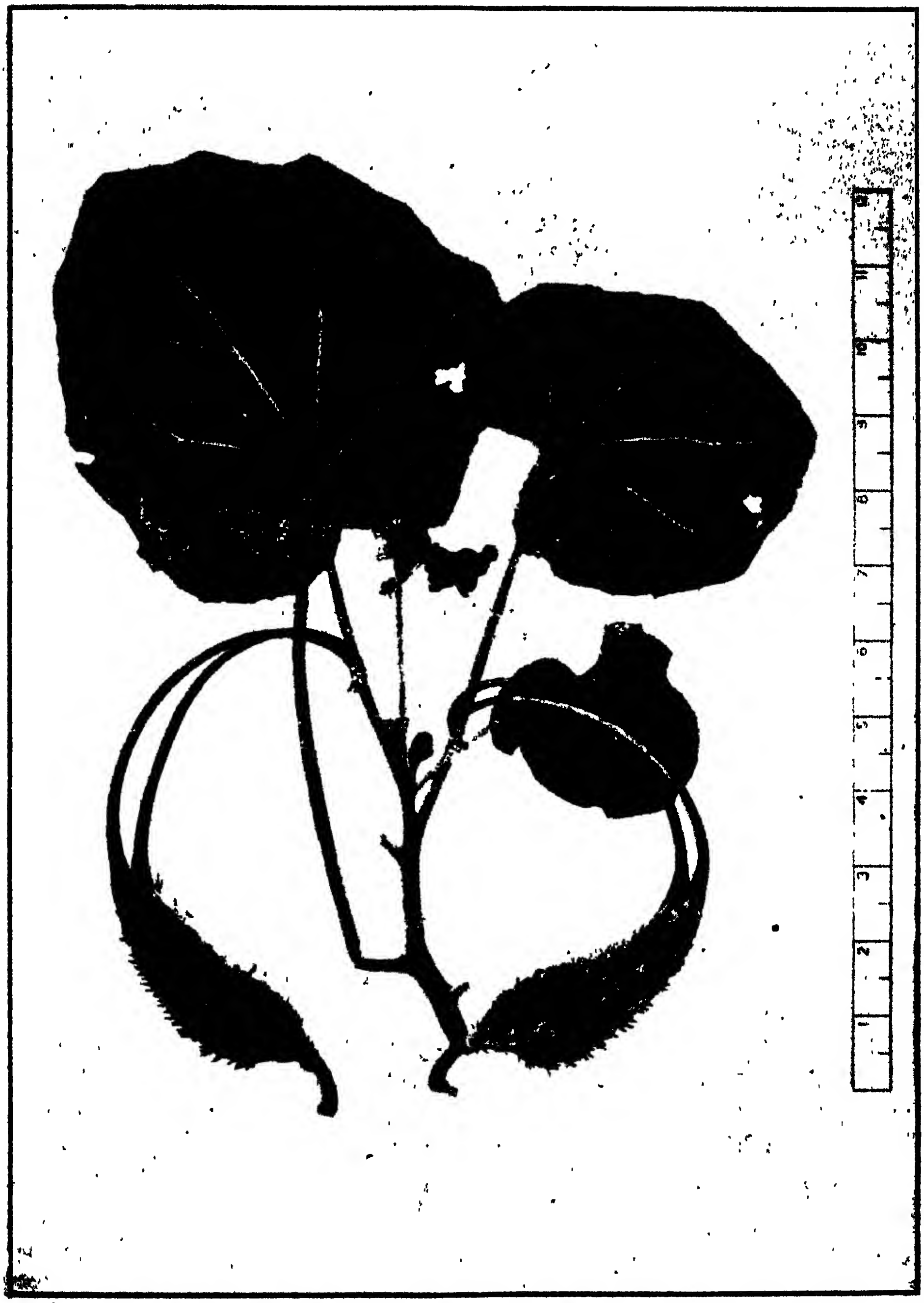
Where found.—It is a native of the Mississippi, extending from Iowa and Illinois southwards to Mexico and California. It is also spontaneous in many parts of America. Seeds were first brought to Paris gardens and afterwards distributed to various parts of Europe. It was cultivated in England by Phillip Miller, who received seeds from M. Richard, gardener to the King of France, before the year 1759.

Its appearance in New South Wales.—It was first recorded as a naturalised weed for this State by Mr. Fred. Turner, in 1905, for the north-western districts. Since then it has been received at the National Herbarium from the following widespread localities—Hay, Wagga, Bringle, Gundagai, Young, Grenfell, Kerrabee, Goulburn River, Burrawong Station, Forbes, Ponto, Dubbo, Narromine, Coonamble, Yagobie, and Delungra.



Devil's Claw, *Proboscidea (Martynia) louisiana* (Mill.) Woot. and Standl.

Nature of the Plant.—In a measure it is an attractive plant, and at first a novelty to most people, and it is therefore given a prominent place in the flower garden, but after a season or two the charm seems to wear off, and it is



Yellow-flowered Devil's Claw, *Proboscidea* (*Martynia*) *lutea* (Lindl.) Stapf.

then carelessly thrown away for its capsules to be kicked and dragged about by stock, and as the hard hooked capsules relax the seeds are distributed over large areas. The capsules are so constructed that they do not shed all the

seed at once; the seeds in the central chamber are the first to be released, and in the course of time, when the hard substance disintegrates from the side chambers their contents are set free.

Owing to their size and nature the capsules are even more injurious to stock than those of the Small-fruited Devil's Claw, described in the *Agricultural Gazette* for May, page 334. The long claw-like spines are specially adapted to catch in almost any object they come in contact with, and being strong and sharp, they work their way into the tender part of the feet of sheep and cattle, and sometimes cause serious lameness.

Mr. H. V. Thorby, M.L.A., commenting upon this plant at the Noxious Weed Conference, referred to it as a terrible pest to stockowners in the western districts. Bailey, in *Weeds and Poisonous Plants* of Queensland, states that it is a pest in some localities in Queensland.

Useful or Otherwise.—Apart from its use as an ornamental flowering plant, it is on record that some of the Arizona Indians use the black fibre of the pods in forming the patterns of their basketry.

It is of little or no value as fodder. As a rule stock do not take to this class of plant; they appear to have very strong aversion to plants emitting a strong odour, and this one also discharges the slimy or clammy substance which is strikingly characteristic of some species of Devil's Claw.

Means of Control.—This class of plant is perhaps one of the simplest to eradicate; it is killed as easily as a pumpkin vine. Once severed from the root it will not grow again, and its only means of reproduction is from seed. If the plant is cut once or twice during the growing season before the seed capsules develop it can be successfully overcome, especially if the infestation is a new one. On old infested areas it may take two or three years to eradicate it, as many of the seeds do not germinate at the same time, some being preserved in the old capsules for long periods. It is advisable, therefore, to gather up and burn any old capsules to prevent further infestations, and also to prevent them from coming in contact with stock.

Yellow-flowered Devil's Claw, *Proboscidea* (*Martynia*) *lutea* (Lindl.) Stapf.

Botanical Name.—*Proboscidea*, see the preceding weed; *lutea*, yellow, referring to the colour of the flowers.

Common Names.—Yellow-flowered Devil's Claw, Devil's Grip, Ram's Horn, Eagle's Claw.

Popular Description.—Similar to the preceding, except that its leaves are sometimes larger and the flowers are more yellow; the capsule, too, is also longer, sometimes exceeding 9 inches in length.

Botanical Description.—Annual, 1 to 3 feet high or the branches prostrate, glandular pubescent; leaves opposite, cordate to orbicular, densely infested with glandular down; calyx involucrated by two bracteas; corolla large, funnel-shaped, orange yellow, mottled with red inside; beaks much longer than the epicarp; epicarp crested on the posteria, and densely covered with short stiff unequal spines; seeds black, rugose.

Where Found.—A native of Brazil, Paraguay, and Uruguay. It was introduced into France and England about the year 1758. In 1920, Mr. W. W. Froggatt, Government Entomologist, recorded it for Queensland. It is now recorded for the first time for New South Wales, from the following localities—Jingellic, Albury, Windsor, Hornsby, and Tenterfield.

Nature of the Plant.—Mr. Froggatt states that it has become noxious in some country districts owing to the seed pod becoming caught in the wool, or getting around the hocks of sheep, cattle, and horses.

Men employed in cutting the plant become extremely dizzy in the head after working on it for any length of time.

The thick end of the capsule is covered with short stiff bristles, and these, together with the two strong, sharp, claw-like spines with which it is furnished, enable it to cling to almost any object it comes in contact with; it is at the same time liable to cause greater injury to stock than any of the allied species.

Means of Control.—As for the preceding species.

Sweet-scented Devil's Claw, ***Proboscidea*** **(*****Martynia*****)** ***fragrans*** **Lindl.**

Botanical Name.—*Proboscidea,* see the explanation to Devil's Claw, page 575; *fragrans,* sweet smelling.

Common Names.—Sweet-scented Devil's Claw, Fragrant Martynia, Unicorn Plant, Elephant's Trunk.

Popular Description.—In general appearance it resembles the two preceding species, but the leaves are more divided and the flowers are a rich crimson-purple, and sweet smelling.

A large flowered form of this species is sold under the name of variety *formosa,* meaning beautiful.

Botanical Description.—Annual, 1 to 3 feet high, clothed with soft glandular down; leaves opposite or nearly so, petiolate, cordate to oblong-cordate, trilobed, lobes rounded sinuate, the middle lobe the largest; raceme terminal, several flowered, flowers fragrant; calyx large, subcampanulate; corolla scarcely longer than the calyx, of a rich crimson-purple; stamens and style included; capsule oblong, curved upwards, crested on the inner side, terminating in two incurved beaks, much longer than the thick base.

Where Found.—It is a native of Mexico, and was first recorded for this State by Mr. Fred. Turner, in March, 1910, from Narromine. Professor Ewart recorded it for Yelea, Victoria, in April, 1918.

Nature of the Plant.—It is a menace to stock similar to its congeners. Mr. Turner states that stockowners regard this plant as a formidable new weed pest.

Means of Control.—Same as for the first species.

The three species have been proclaimed noxious under the name of Devil's Claw in the undermentioned localities:—

Shires.	Municipality.
Carathool.	Hay.
Macquarie.	
Waradgery.	
Wingadee.	

Rural Credit and Community Settlement.

ELWOOD MEAD, D.E., Professor of Rural Institutions, College of Agriculture, California.*

THERE are three features of the subject now before you about which I would like to speak, viz., the need of credit in farming, the agencies that are being provided to meet that need, and the merits of the Bill that you are considering.

The need of credit grows out of the greater cost of land and of everything needed to equip a farm. All the implements in use on my father's farm when I was a boy cost less than a single tractor in use to-day. All the wheeled vehicles cost less than the motor-car that to-day is regarded as a necessity. The time has come when we must work with better tools, have better stock, and use more science and skill in farming operations in order to receive larger returns, and so earn interest on the larger investment. We have been slow in devising credit facilities to meet these needs.

On Monday of this week I talked with a dairyman who said that his need and that of his neighbours was silos to hold fodder for dry periods. He said that the people in his section would lose more this year than the cost of a silo for every farm in the district, and he went on to speak about the lack of money, saying that the same was true of his neighbours. I know exactly how reluctant he would be to mortgage his farm in order to obtain the money. It would be a slow and difficult process, and there would be publicity that he desired to avoid. Later on, I met an expert connected with the Agricultural Department. We were discussing the same district, and he said that its dairymen would not be successful, or as successful as they should be, until silos were a part of their equipment. You are devising machinery that will enable those people to obtain this money as a community operation, by acting in co-operation one with another, so that they would all feel that they were engaged in a common adventure. Borrowing money would not then be an individual matter—it would be a sign of community progress.

Recent experience in America shows how largely this system is being employed, and how great is the need for some adequate machinery, such as you propose to set up here, to provide money on favourable terms. Some fifteen years ago the citrus growers were losing money. The people who grew oranges left the selling to agents, while people in cities established packing sheds and looked out for markets, selling the goods under their own brands. The growers had no direct contact with the consumers, and were

* Notes of an address delivered at the State Conference of the Agricultural Bureau of New South Wales, held at Hawkesbury Agricultural College, Richmond, 19th to 22nd June, 1923.

dependent on city agents for finding markets and fixing prices. Then the growers decided to co-operate, and to do their own wholesale selling. They realised that if they did co-operate it would have to be on a large scale, so that they could control nearly all the product. Only in that way would they be able to fix prices. The plan adopted was to have a central selling office, in contact with the markets, able to furnish information about markets, no matter how remote they might be. The growing, packing, and shipping, and all mechanical operations were carried out by the districts where the fruit was grown. There are now 100 of those separate centres, and they are authorised to sell their goods direct, or if they prefer, to sell through the central office. One of the conditions of joining the association was that all fruit was to be sold under the association brand, so that anyone who bought "Sunkist" brand would know what they were getting. People did not need to know whether it came from the southern or northern part of the State. The brand was sufficient. That meant that they had to own the sheds and do the packing.

One association made up of eighty members, most of them having 15 to 20 acres, will illustrate how they found out the need for credit. This association had to arrange for a packing shed. They could either have built a new one or bought the old one, and in order to do that they had to pay in the neighbourhood of £18,000. You can figure how much that meant for each acre of the total 1,500 acres. It meant, of course, going into debt. It meant raising a large sum of money by individuals who were not used to raising money, and who had no machinery through which to obtain it, but each individual borrowed his share from friends or from a bank, and they packed their own crop and found the result satisfactory. The next year, with larger trees and a larger acreage, the shed had to be increased. They had to renew the old bills and also make new ones. It frequently happened that the meetings of this association were largely taken up with the worries of the individual members as to how to take care of this load of debt.

Later the association needed a citric acid plant to treat the rejected fruit. That also cost money and meant more borrowing. Then they became convinced that by co-operation they could own and operate a fumigating plant as a community, and do better work at less expense. It was also evident that if they owned the trucks needed to bring the fruit in there would be a great saving in the amount of money expended, as well as a larger and better use of the equipment. The idea of each individual standing on his own had been abandoned. Their success, the desire they had to go on and make it complete, showed the need for better financial machinery. They formed a corporation, and issued bonds secured by their equipment. That took the burden of financing off the individual. They financed the whole investment with less worry and less cost than when each individual looked after his own share. To-day they have invested in their various enterprises connected with the preparation and marketing of their fruit about £70 per acre on every acre of their land. The question may be raised whether they

could afford to do all this. The answer is that if the growers could not, the people who furnished those facilities could not afford to do it. The money had to be raised from somewhere, and interest had to be paid on it.

That is not an isolated experience. Each of the 100 separate units of the California Fruit Exchange has had the same need to borrow on community credit A generation ago the idea of pooling credit, or of handling marketing problems, never occurred to farmers in America. The California Fruit Exchange is duplicated by sixty other co-operative selling societies that handle farm and orchard properties in California

Now we come to the machinery. You need something like you propose to provide under this Bill. That is what California needs. We are moving in the same direction. The Federal Land Bank of the United States has helped to provide money. I believe that if we had State rural credit the machinery would be less cumbersome. But the national system has been better than nothing. Under the emergency legislation created since the war, the War Finance Corporation has loaned 100,000,000 dollars in emergency loans, which is more than the total loans of the Federal Land Banks. That merely serves to show the need of farmers for credit. Recent American legislation has extended the function of the Federal Land Bank, which was formerly only a mortgage bank. It has created short time credit banks that permit local associations who can bring together a capital of 10,000 dollars to go to this bank and borrow money. For the first time America is providing in an orderly and systematic way for short time rural credit.

There is also need in America for machinery to provide a larger amount of money for the equipment of farms. You have provided for it here in your State Savings Bank. The Federal Land Banks of America have been conservative. They only lend up to 50 per cent. of the value of farms, and they will not lend above a certain amount per acre, no matter what the security is. No one can measure the benefits that have come from what has been done, however.

Now, in regard to this measure that you have before you, there is one feature that I hope will be fully utilised, viz., the union of rural and urban credit. Make it apply to both the city and country. I have been connected with efforts to bring about co-operation in a local way between cities and the surrounding farming country. All our efforts have come to nothing because of the indifference of the consumer. He or she will not go to any trouble to make the road direct from producer to consumer. I believe that the machinery of this Bill will work. If there is any lesson in our present situation, it is that as the world gets older and people are crowded closer together, they have to think less of themselves and more of those things that concern the common welfare. We have left the day of individualism. We have come into the day of co-operation, and to make that as effective and as valuable as it should be, you must have machinery of the kind that is now being placed before you in the preparation of this Bill.

Rice-growing on the Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Senior Agricultural Instructor.

DURING the season 1922–23, the Water Conservation and Irrigation Commission co-operated with the Department of Agriculture in carrying out a rice trial on the Yanco area.

An area approximating 2 acres was sown with three varieties at rates of seeding of 85 lb., 95 lb., and 108 lb. per acre respectively.

The land used in growing the rice was of the heavy red clay type. Much trouble has been experienced in the past with this class of land, owing to the difficulty of getting the water into the soil sufficiently deep, and to the setting of the surface soil after irrigating.

This particular piece of land had been planted with fruit trees some years ago, but for some time it had not received any attention, the trees having been taken out. Thus it was practically new land, or, at all events, it had not been improved by cultivation or by the addition of manures.

Preparation of the Land.

The land was ploughed in July, about 3 inches deep, with the disc-plough. Owing to its uneven surface, the result of former treatment, it was necessary to grade it to ensure even watering. Check banks were put in to hold the necessary water on the growing crop. The land was cultivated in September, and sowing was carried out on 28th September. The seed was sown with the ordinary wheat drill through the fine side of the hopper. It was noted that the seed ran about 25 per cent. slower than wheat. No fertiliser was used.

A few days previous to sowing a light fall of rain was recorded—about 20 points—which left the land in good condition at sowing time. It was found necessary to irrigate the land on 8th October, and again four days later, the first application being made to assist germination, and the second to prevent the surface soil from setting hard. The first plants made their appearance between the two waterings, and a very good germination was obtained. After the second watering, quite a lot of weeds sprang up. The crop made very slow growth at the start, but as the warmer weather was experienced it came away more rapidly.

The crop was submerged on the 22nd November, and the water was gradually raised to a height of 5 inches, at which it was maintained until it was taken off later in the season.

The flow of water was so regulated that a regular supply was at all times available, and it was kept moving the whole time it was on the crop. The checks were so arranged that the water was supplied at the higher levels and taken off at the lower. It could be said that a constant renewal of water was being carried out the whole time. From accounts of trials conducted in other parts of the world, it is doubtful if this constant supply of moving water is necessary, more especially as the water used is practically free from harmful alkali, and the heavy-class land does not encourage the rise of alkali or salts from below. All that should be necessary is a sufficient supply to renew losses due to evaporation, transpiration, and seepage, and to maintain the correct level.

Rice Crop submerged on the Murrumbidgee Irrigation Areas.

Very cold weather was experienced towards the end of December, the reading of the 31st being 41·5 deg. Fah. This had the effect of turning the leaves of the rice plants quite brown—in fact, they withered and died. Almost immediately the plants threw out new growth of healthy leaves. A recurrence of this "browning" of the leaves took place in February, but only to a very small extent.

The first panicles were observed in one plot during the second week in January, and it was followed by the other varieties at intervals of twelve and eleven days respectively.

The crop attained a height of 3 feet, and was very even throughout.

Draining off the Water.

On 26th February a start was made at taking the water off No. 3 plot, the operation extending over ten days. Care has to be taken in draining off the

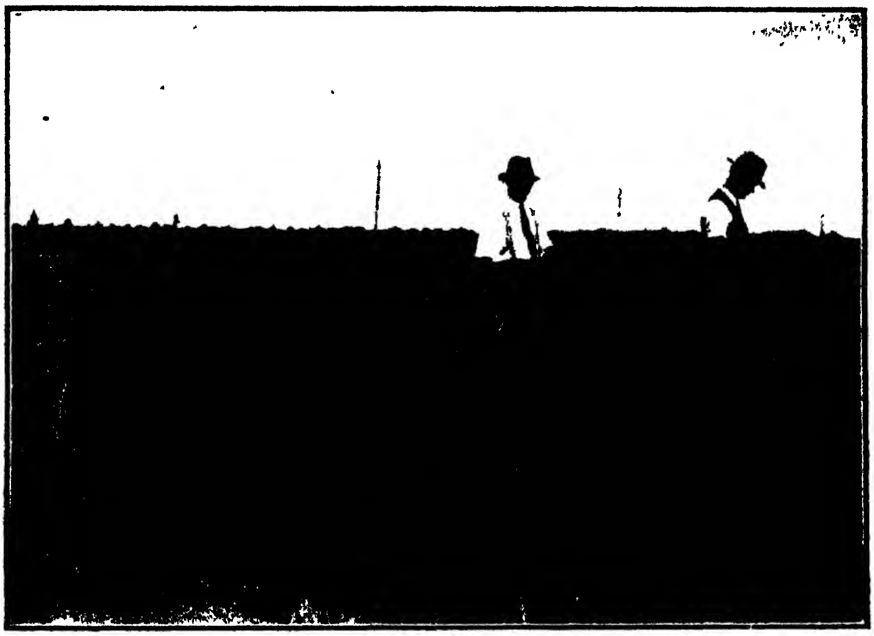
water not to do so too quickly, so that at the same time the soil shall harden up and the plants be prevented from falling. The grain at this stage was in a tough dough state, and the panicles were well turned down.

The other plots were similarly treated, about fourteen days later in each case.

Time must elapse after the withdrawal of the water before harvesting to allow the land to become sufficiently firm to carry the harvesting machinery.

Harvesting.

Ordinary wheat harvesting machinery was used, a combined harvester and a reaper-thresher being employed. Both machines did very good work, but with minor alterations the latter should be the most suitable. The



A Crop of Rice before cutting.
Note the drooping panicles.

machines were light in draught, and the horses had little difficulty in pulling in the 76-bushel crop. A very fine sample of grain was obtained, no trouble being experienced in cleaning it with the machines.

No. 3 plot was harvested on the 5th April, and Nos. 1 and 2 on the 18th and 19th. The straw was quite green at harvesting time.

The yields obtained were as follows :—

Plot No.	Variety.	Yield.
1	Wataribune	3,223 lb.
2	Colora	3,039 ,,
3	Colusa	3,030 ,,

The varieties under trial are what are known as Japanese short grain rice.

The following is a comparison of the variety Wataribune, grown at Rice Experiment Station, Crowley, U.S.A., and the same variety grown locally.

	Sowing.	Crop above ground.	Crop Submerged	First Heading.	Date of Maturity.	No of days to Maturity. From Sowing.	No of days to Maturity. From First Heading.	Days of Submergence.	Yield.
									lb.
U.S.A.* ..	3 May	18 May	16 June	14 Aug.	17 Sept.	137	34	93	2,727
Yanco ..	28 Sept.	10 Oct.	22 Nov.	14 Jan.	5 Apr.	189	80	96	3,223

* The data of the American crops are taken from Bulletin No. 1,127, Department of Agriculture, U.S.A.

The difference between the length of time taken to mature from first heading can be accounted for by the fact that whereas the United States sample was cut and threshed the local plot was stripped. If the two lots had been similarly treated, doubtless the difference would not have been so great.

A Reaper-thresher at work in the Rice Crop.

It is claimed that the plot grown at the Crowley Station was on the typical rice soil of the prairie, which contains approximately 4 per cent. fine sand, 69 per cent. silt, and 23 per cent. of clay. It is of a brown colour, and rather compact in structure, with a tendency to puddle when ploughed in a wet condition. The subsoil, which lies at a depth of 16 inches, is a mottled blue-and-yellow clay, which is so impervious that there is no seepage through it. The land had been ploughed during the winter and then received a discing before being sown in the spring. The rice was sown on land that had grown soybeans the previous year. These had been sown in rows 4½ feet apart, and were cultivated. This cultivation kept down weeds and assisted in keeping the land clear for the rice. The bean seed was harvested, and the stems and leaves ploughed under. Thus the practice of green manuring was resorted to.

It will thus be noted that the results as obtained locally compared very favourably with those obtained in America. Doubtless if acclimatised seed had been used, better results could have been looked for.

A sample of the paddy (rice in the husk) was submitted to a Sydney merchant, who reported it to be "a very nice sample of the Japanese variety, which should mill up very satisfactorily."

It is hoped that during the coming season the trials with rice will be very much extended, and that definite data will be obtained as to methods of waterings, quantity of water, and other interesting facts.

If yields similar to those obtained last season—and there is nothing to prevent them—could be got on large areas, rice-growing should be a new industry to the irrigation areas. Rice-growing would open up a new adventure for those settlers with the poorer-class lands, and as the crop (like wheat) can be handled with machinery, the grower is not dependent on labour to any great extent. Another point much in its favour in these parts is that the actual work of sowing and harvesting is done during the cooler parts of spring and autumn. In addition to the grain from the crop, the straw should also have a commercial value.

Value of Crop.

From inquiries made of the rice importers in Sydney, it is gathered that the prices of rice fluctuate to a certain extent. One importing firm stated that the present price of " paddy " in Burmah was in the vicinity of £7 per ton. It is understood that the grain is usually imported in the uncleaned state—that is, as de-husked rice. This is chiefly for the reason that considerable freight is thereby saved, the hull amounting to from 15 to 20 per cent. by weight. The price of uncleaned rice is from £10 to £12 per ton, Sydney.

At the present time uncleaned rice is imported duty free, whereas the duty on cleaned rice is 3s. per 100 lb. Quite recently a duty of 3s. 4d. per 100 lb. on uncleaned rice and 3s. on cleaned rice was removed.

The weight of the bushel of rice varies from 42 to 46 lb., according to variety and quality.

TO RAISE *Pinus insignis* FROM SEED.

PLANTS of *Pinus insignis* are easily raised from seed. Prepare a box or frame of the required size, and fill it up with soil to within 2 inches of the top. Scatter the seeds (which must be gathered in a fresh condition) over the surface and press them into the soil, with the hand or with a piece of wood. Spread more earth over the seed, up to within an inch of the top of the box, and partially shade with a few twigs.

The seeds should germinate in a few weeks. When the seedlings are 2 to 3 inches high, transplant them into pots or into the positions in which they are required. Seed sown early in the spring should provide seedlings ready for transplanting in the autumn.—J. H. MAIDEN.

Field Experiments with Cotton.

GRAFTON EXPERIMENT FARM.

M. J. E. SQUIRE, Experimentalist.

A COTTON trial was conducted at this farm during the past season. The summer was exceedingly dry for the district, and the temperature very high in December, January, and February. Light showers of rain were generally followed by hot drying winds, and were often more detrimental than beneficial, as the surface mulch was usually destroyed.

The rainfall during the growing period was as follows :—

October 5th to 31st	3 wet days	108 points.
November	3 ,,	96 ,,
December	8 ,,	165 ,,
January	8 ,,	341 ,,
February	7 ,,	159 ,,
March	5 ,,	144 ,,
	Total	1,013 points.

Seed of the Lone Star variety was planted on 5th October on the upland, drills 3 feet apart being opened with a mouldboard plough, and the seed being dropped by hand and covered with a single-horse cultivator. Thick seeding was adopted to ensure a good stand. A plot 0·18 acres in area was sown.

The soil is a red volcanic loam of basaltic origin, and it was in excellent condition at the time of planting. The land had been ploughed on 31st August, harrowed, rolled, and re-harrowed on 1st September, and ploughed a second time on 4th October, and then harrowed down prior to sowing.

The germination was fair. Thinning was carried out when the plants were about 10 inches high, leaving plants 8 inches apart in the rows. Owing to the dry conditions growth was slow and the plot only attained a height of 18 to 24 inches.

The plot was in full bloom early in January, and harvesting commenced about the middle of February, and was completed by the middle of March. Three pickings were made. The yield was at the rate of 444 lb. per acre, the quantity o fseed cotton on hand being 80 lb.

Considerable damage was done by insect pests, and the flare was successfully used as a means of reducing the number of the monolepta beetle. Though the night on which it was tried was a bright moonlight one, the flare proved very successful. It was held stationary between the rows, and slightly above the plants, so that the beetles rose easily into the flame, the nearest plants being shaken to disturb them. When they had ceased to come to the light the flare was moved on a few yards. As the insects generally confine their attack to a fairly small area at a time, the operation did not take very long. No further trouble was experienced from this pest, and the flare certainly destroyed large numbers of other insects.

The Cultivation of Cotton in New South Wales.

H. WENHOLZ, B Sc. Agr., Special Agricultural Instructor, and
E. S. CLAYTON, Agricultural Instructor.

No crop in the history of New South Wales has received greater publicity than has cotton during the past few years. The wide and constant publicity that it has been given through the daily press and by other means has had the effect of interesting business men, bankers, manufacturers, land agents, politicians, and farmers almost throughout the State, and innumerable inquiries have been and are still being directed to the Department of Agriculture for guidance as to the prospects of the crop in New South Wales.

Although successfully grown in Queensland for some years, especially recently, owing to the good prices prevailing, there had not, prior to 1921, been any commercially profitable crop known to be grown in any part of New South Wales. For many years the Department of Agriculture has been growing cotton on an experimental scale on some of its experiment farms in this State, and in 1920, 1921, and 1922—particularly in the last year—seed was supplied to farmers for trial in many parts of the State. With the exception of a few districts in the North which produced profitable crops during this last season, cotton is still in the experimental stage, and further tests are required before the crop can be recommended as profitable in other districts. It must be borne in mind also that cotton must be proved to be an almost equally profitable crop or a more profitable crop than those already being grown or capable of being grown on the farm before it can well be recommended.

The farmer will have largely to discover the economy of cotton-growing for himself, and he will be wise to content himself, in the main, with testing it by experiment on a small scale before he makes any sudden change to include cotton in the farm practice to which he has been accumstomed, except of course in those districts where it has already been proved a profitable crop. Even there it will be found best to restrict the area to that which can be properly handled. Such advice is necessary because some over-enthusiastic people are likely to be carried beyond economic limits, and to get themselves into hopeless positions which they will afterwards regret. One hears, for instance, of farmers intending to plant 50 or 100 acres in districts where cotton should still be regarded as an experimental crop, or where growers could not expect to procure the abundant labour which the picking of such a crop necessitates.

Mature cotton can be produced in nearly every part of the State except the colder parts of the tableland districts, but to produce a good yield and a profitable crop of cotton under average natural conditions is a very different matter. Nearly 5,000 farmers in New South Wales tried cotton in a smaller or larger experimental way last season (1922-23), and although the majority may have produced some mature cotton, it is probably safe to state that less than 100 obtained such results as would justify them going yet beyond the experimental stage with the crop. In fairness, it must be allowed that in some districts the dry season militated considerably against the success of the crop (though in places of heavy average rainfall such a season may have been a considerable advantage), that many plantings were too late to expect success, that poor germination caused bad stands that largely reduced the yields, and that the crop was tested in some districts in which cotton-growing can only be a forlorn hope or a wasted effort at any time. In some districts also which will probably grow cotton successfully there were very few trials.

It is proposed therefore to supply a pressing need for information, and to afford guidance in the matter of cotton-growing in New South Wales. Though this information is based on a moderately short experience in some districts—yet probably a greater local experience owing to the careful unbiassed or unprejudiced observations of its field and scientific staffs than could be obtained by any other individual or organisation—the resources at the disposal of the Department of Agriculture, its touch with information on cotton-growing in other countries, and other factors of advantage that it may claim, make the information contained herein probably the best that can be given on the subject at this date. Further experience will, of course, supplement the matter presented here to make it still more useful. Carefully controlled or supervised experiments conducted by the Department will throw further light on certain phases of cotton growing and provide more data which will guide cotton-growers in the direction of making the crop more profitable. Pure seed of the best American varieties has already been introduced by the Department, and will be made available to farmers when sufficiently increased and selected on the experiment farms, and variety trials will serve to indicate the best yielding varieties for different districts.

The Present Cotton Situation.

The fact which has drawn attention to cotton in recent years and to the possibility of its greater production in Australia has been the increased prices. America produces, roughly, three-fifths of the world's supply of cotton, and although in pre-war days English manufacturers obtained the bulk of their supplies from the United States, very short supplies of cotton were obtained from that country during the war owing to America's increased consumption for manufacture at home. In recent years Britain has not been able to obtain sufficient supplies from America owing to decreased production there, and is now looking to other countries to supply her needs. This has had the effect of increasing the price, as will be seen

from the fact that the price for cotton lint in America rose from 9 cents per lb. in 1914 to 31 cents in 1919. It was about this time that the production of cotton within the Empire was recognised to be so important that the Board of Trade, London, appointed a committee known as the Empire Cotton-growing Committee to inquire into the question. The result was the establishment of the Empire Cotton-growing Corporation by Royal Charter in November, 1921, with Earl Derby as its president. The sum of £1,000,000 was placed at its disposal by the British Government out of profits made during the war on the sale of Egyptian cotton, and certain cotton spinners in England have also voluntarily taxed themselves to the extent of 6d. per bale (500 lb.) on all cotton imported into England.

During 1921-22 the Empire Cotton-growing Corporation assisted in furthering cotton-growing in Queensland by joining with the Government of that State in supporting the guarantee to farmers by agreeing to pay 1s. 6d. per lb. for cotton lint grown in Queensland.

Support of the cotton-growing industry in Australia by the Empire Cotton-growing Corporation has now been withdrawn except for the services of Mr. G. Evans, expert adviser to the Queensland and New South Wales Governments, and it is understood that the Corporation is confining its attention chiefly to cotton-growing in Uganda, Nigeria, and the Sudan, where there are abundant supplies of cheap black labour. From this it would appear that the withdrawal of support is due to doubt on the part of the Corporation that cotton can be economically produced in Australia in large quanties owing to the conditions in regard to labour.

There is, however, definite proof that cotton can be successfully grown on a small individual scale in Australia, especially in Queensland and some northern parts of New South Wales, even under present labour conditions, so long as prices remain high.

The Government Guaranteed Price.

In order to encourage cotton-growing in New South Wales, so that farmers may become acquainted with the economy of the crop and its cost of production in comparison with other crops, the Government has decided to assist the farmer for the first few years by giving a guaranteed price. It is hoped that by this means farmers will gain sufficient experience with the crop to enable them to decide how far it can be fitted into farm practice, and at what price it will pay them to grow the crop when the guarantee is removed.

The New South Wales Government guarantees to pay the following prices for seed cotton grown in New South Wales upon the conditions set out:—

Season 1922-23.—Five pence half-penny (5½d.) per lb. for all seed cotton of ⅞-inch staple and over.

Season 1923-24.—Five pence (5d.) per lb. for all seed cotton of 1⅛-inch staple and over, and four pence half-penny (4½d.) per lb. for all seed cotton of ⅞-inch to 1⅛-inch staple.

Season 1924-25.—Four pence half-penny (4½d.) per lb. for all seed cotton of 1⅛-inch staple and over, and four pence (4d.) per lb. for all seed cotton of ⅞-inch to 1⅛-inch staple.

The above prices are for seed cotton delivered at the ginnery, provided it be of good quality, properly packed and consigned as directed, and is received in good condition.

"Seed cotton" means cotton derived from seed planted annually.

"Good quality cotton" means seed cotton that is clean, free from disease or damage by insects, weather, or through any other cause, and is not immature, stained, dirty, or otherwise damaged, and is not ratoon cotton.

"Ratoon cotton" means cotton derived from plants of more than one season's growth.

Seed cotton that cannot be accepted as good quality cotton may be paid for at a price to be determined by the Minister at his option, or arrangements may be made for such cotton to be treated and sold on the owner's account, or otherwise dealt with as the Minister may decide.

Should ratoon cotton be mixed with seed cotton, the whole consignment will be rejected at the risk and expense of the sender.

The guaranteed price will be paid only on seed cotton derived from areas not exceeding 50 acres.

In the event of the sale price showing a surplus over and above the price paid to the grower, plus the amount of freights and all expenses incurred in preparation and marketing, the profit will be distributed amongst the growers.

The Government will provide funds to enable the cotton to be prepared and placed on the market.

The grading and inspection at ginneries of cotton that is subject to these advances will be under the supervision of officers of the Department of Agriculture, and their decision, subject to the right of appeal to the Minister, shall be final.

Cotton subject to these conditions must, for the year 1923, be accompanied by a proper advice note, and addressed to the British-Australian Cotton Association, Limited, Waratah, Newcastle, and freights—rail or boat—must be prepaid. Upon its receipt the grower will be advised of the weight and quality, and a cheque will be forwarded by the Department of Agriculture in due course, in accordance with the Government guarantee.

The British-Australian Cotton Association is purely a trading company. It has shown commendable zeal and enterprise in undertaking the business risk of establishing ginneries in New South Wales and Queensland and marketing the lint in England. It is this enterprise which has made possible the growing of cotton in New South Wales as a commercial crop.

(*To be continued.*)

Soil Improvement on Yanco Irrigation Area.

A. N. SHEPHERD, Senior Agricultural Instructor.

THE problem of soil improvement is the chief difficulty of many settlers on the Murrumbidgee Irrigation Areas, and more especially those situated on the heavy clay soil.

It will be readily admitted that these soils suffer greatly for want of humus. The intense heat of summer, usually accompanied with high winds, tends to burn out and blow away much vegetable and animal matter that in more temperate climates would remain and supply the necessary humus to improve the soil from both a mechanical and a chemical point of view.

Apricot Trees on Mr. Roberts' Farm, Murrumbidgee Irrigation Area.

The land of the outside rows was treated with 1 ton of gypsum per acre, and that on the inside was untreated. Note the difference in the foliage.

With the heavy soils of the clay type the tendency is to become more compact and settled together the more they are irrigated, so that in a very short time it is almost impossible to get the water to percolate to any depth. After irrigating it is found, upon examination, that the water has only soaked into the soil for a few inches, and that it dries out, leaving the soil hard and compact resembling a sun-dried brick. One day the ground is too wet and sloppy to carry horses and machinery, and the next it is almost too hard to cultivate, or at all events to make a good job of it.

Many methods of cultivation and irrigation are practised in orchards on such soils with the object of bringing the fruit to marketable size. One method that has given results is to run the plough with the mouldboard off between the trees before the fruit starts to ripen. This gives a very deep cultivation without bringing clay to the surface, and allows more water to soak into the soil, where it is available for the trees when they are in need of a bigger supply to fill the fruit and mature it.

During the past season gypsum has been extensively used, and it promises to be of immense benefit to settlers less fortunately placed as regards the type of soil on their farms. It has been found that where a dressing of gypsum has been given the texture of the soil is much improved. A point much in its favour is that the land dries more evenly, and it is possible to get on to it and to cultivate it from one to two days earlier, thus conserving moisture that would otherwise be lost by evaporation. The land also cultivates much more easily, and is more mellow and friable. After heavy rain the soil does not set so hard; in fact, cases have been noted where water lies on the surface of the untreated land, whereas on the gypsum-dressed soil no surface water is to be seen.

In the accompanying illustration the outside rows of trees received a dressing equivalent to 1 ton of gypsum per acre last winter, whereas the centre row was untreated. One has not to look too closely to see the effect on the growth of the trees. In the case of the trees growing on treated land, there is much more foliage than on the centre row.

Mr. Roberts, on whose farm the photograph was taken, states that while the trees that received the gypsum returned a crop of good apricots, not a single fruit was picked from the other row, those that did form being very small, and failing to mature. All the land received the same treatment, being furrow-irrigated, whilst the deep furrow in the middle of the row—really a "finish-off" in ploughing—was specially left to drain off any surplus water.

Another interesting feature about Mr. Roberts' trial was that better results were obtained where the gypsum was spread on the surface and cultivated than where it was spread and ploughed under.

At the present time the Department is conducting trials on several farms in the matter of soil improvement, using gypsum and lime separately, and also trying green manuring in conjunction with both the dressings. Different rates of application are being used, ranging from ½ ton to 1½ tons of the gypsum and ½ ton to 1 ton of the lime. So far the gypsum appears to be giving the best results; but neither the gypsum nor the lime seemed to have benefited the green manure crop—oats and tick beans—from a growing point of view. It is intended to extend this trial over a period of four years and until further information is obtained the results cannot be taken as definite.

Apples on the Murrumbidgee Irrigation Areas.

THE accompanying illustrations show apple-trees on Mr. C. W. Ziele's farm on the Murrumbidgee Irrigation Areas. The land is some of the heaviest on the areas, the soil being more or less shallow clay loam, with heavy clay subsoil. Mr. Ziele has given the block excellent attention, and the mechanical texture of the soil has considerably improved under his management. It is interesting to know that apples can be produced on this soil, the block being considered one of the hardest propositions on the Yanco section.

Fig. 1.—Apple-tree, six and a half years old, at Yanco.

The tree in Fig. 1 is from 18 to 20 feet high. With the rest of the block, it was planted six and a-half years ago, and it is estimated that each tree carried this season from 6 to 8 bushels of perfect fruit. The variety is Granny Smith.

Fig. 2 shows a later plantation of the same variety made by Mr. Ziele two and a half years ago. The growth of the trees can be estimated by the fact that the figure in the illustration is about 5 feet 9 inches in height.

Fig. 2.—Apple-trees, two and a half years old, at Yanco

The Granny Smith has shown excellent keeping qualities on the Irrigation Areas without artificial aid. It reaches fine eating condition about July, and appears to hold over until September or October.

A Note on Japanese Privet (*Ligustrum Japonicum*).

Various species of *Ligustrum* have been suspected of being poisonous in various parts of the world, and doubt has been expressed as to the possibility of the above privet being poisonous to stock.

At Hawkesbury Agricultural College the following experiments were undertaken:—

A culled ram was starved on 20th July, and next morning was fed a mixture of 1 lb. of leaves and seeds of the privet. Fresh water was provided daily. The sheep ate the plant readily, and on the 23rd the quantity was increased to 2 lb. This was continued daily until 4th August. The sheep was then in fair condition, and had eaten freshly-cut privet daily for a fortnight, and at no time was obesrved to show abnormal symptoms.

Two or three months old Berkshire pigs were starved on 20th July, and from thence were fed as follows:—One would not eat berries alone, so was given 1 lb. of berries in 15 lb. of swill daily. In the afternoon 1 lb. of the leaves were fed. The other pig received 1lb. of chopped freshly-cut leaves in 15 lb. of swill in the morning, and 1 lb. of leaves in the afternoon. Each day the pigs ate their rations, and on 28th July the experiment was concluded, neither pig at any time having been observed to be abnoraml. —F. Whitehouse, B.V. Sc.

Poultry Notes.

August.

JAMES HADLINGTON, Poultry Expert.*

In view of present day ideas regarding laying strains, utility *versus* show birds, and the usual stock arguments in this regard, it might be profitable to review what has really been accomplished and to ask ourselves have we so largely increased egg-production as is generally imagined. If we have, what are the factors responsible for such increase ?

It is claimed that as a result of continuous breeding for egg-production, we have produced the super-layer and have very materially raised the general average of egg-production. To what extent have we done so, and if we have largely increased production, is it due to breeding on blood lines from noted layers, or is any part of it due to a better knowledge of selection, rearing, and general management? If it is acknowledged that poultry-farmers generally have improved their methods, what measure of credit is due to that particular circumstance, and how much is due to the factor of inheritance?

It will, I think, be generally admitted that performances, both collective and individual, in the College competitions should give the best evidence—at any rate, we have no other evidence of a reliable character. We will take it, then, that for the past twenty years practically the sole objective of utility poultry-farmers in this and many other countries has been centred on increased egg-production. That being so, let us examine the factors that have contributed to the position that we believe has resulted from such efforts.

First, let us take the average of all breeds competing in the egg-laying competition, and (excluding the first test, which I do not regard as comparable) we start on the second year with a general average of 163 per hen, while in the last we finished with an average of 191. In the intervening tests as high as 206 has been attained. On a superficial review of these results it would appear that, taking the highest point, there has been an apparent increase of 43 eggs, and on the lowest recent point (the last test) of 28 eggs. This, on the surface, would appear to be a very considerable gain in production.

* These notes were prepared as a paper for the Conference of Poultry Farmers at Hawkesbury Agricultural College on 21st July, but were not read.

But let us see how far this hypothesis is sound. In the early tests there were thirty-one breeds and varieties competing, while in the last test there were less than one-third of that number. Among the thirty-one breeds there were at least twenty that are generally acknowledged to be indifferent or poor laying breeds. So that to answer the question, "what factors are responsible for our increased average egg-production?" an analysis of the breeds that competed twenty years ago with those competing now is necessary.

In the early years nearly all the soft feather breeds usually exhibited at that period were entered in the tests, but as a result of the competition and of the general awakening to the necessities of commercial poultry-farming, many breeds and varieties have dropped out of the running. It has been a case of the survival of the fittest. All this brings us to the question of the averages of the various breeds, and disposes of a good deal that has been attributed to other factors. So far our tests have proved that Leghorns, Orpingtons, and Langshans are the breeds that have most consistently held their own as high producers throughout the twenty years of the competitions. They are therefore the breeds mostly run on our commercial poultry farms.

The Super-layer.

Next comes the super-layer, which most people think has been evolved by breeding. By this term we understand the hens that have laid 300 eggs and over. Are such hens the outcome of skilled breeding, or have they simply been discovered by single pen testing, as has been the case with many hens that have laid two eggs in one day—the possibility of which was previously denied? Looking back over my experience and observation, I have little doubt but that they have existed as long, at any rate, as I have known poultry.

Again, in the earlier years, prior to the stimulated efforts brought about by our competitions for higher egg-production, there were many exhibition breeders competing, and some of these put up very creditable performances. One group of White Leghorn hens put up an average as high as 225 per hen—another evidence of breed averages as a prime factor in the general averages. These facts may be somewhat of a disillusionment to some who believe that all the improvement in egg-production has been due to the factor of recent inheritance.

In order that breed averages as a feature in the apparent increase in average egg-production in the competitions may be more clear, I have extracted from the records the performance of the highest producing group of White Leghorns in each year. This should give some idea of the laying power of the breed in the early years in comparison with to-day.

Leading Groups of White Leghorns in each year of Egg-laying Tests at Hawkesbury Agricultural College.

No of Competition.	Owner.	Group Total.	Average Per Hen.
		Eggs.	Eggs.
1	....	......	......
2	C. A. W. Weil	1,225	$204\frac{1}{6}$
3	J. Low	1,193	$198\frac{5}{6}$
4	L. S. Luck	1,411	$235\frac{1}{6}$
5	S. Ellis	1,437	$239\frac{1}{2}$
6	P. Low	1,474	$245\frac{2}{3}$
7	Mrs. E. L. Snowden ...	1,379	$229\frac{5}{6}$
8	R. H. Stewart ...	1,394	$232\frac{1}{3}$
9	H. Hamil	1,321	$220\frac{1}{6}$
10	Cowan Bros.	1,389	$231\frac{1}{2}$
11	S. Champion	1,461	$243\frac{1}{2}$
12	D. Salter	1,360	$226\frac{2}{3}$
13	S. Champion	1,541	$256\frac{5}{6}$
14	L. Graham	1,449	$241\frac{1}{2}$
15	J. M. Weaver	1,526	$254\frac{1}{3}$
16	M. Chalmers	1,525	$254\frac{1}{6}$
17	M. McInnes...	1,448	$241\frac{1}{3}$
18	J. J. Vaughan . .	1,438	$239\frac{2}{3}$
19	J. J. Vaughan	1,516	$252\frac{2}{3}$
20	L. Graham	1,480	$246\frac{2}{3}$
21	H. J. Cox	1,425	$237\frac{1}{2}$

What emerges from a study of these and other figures to which I have referred in order to arrive at a reasonable estimate of the position as to increased egg-production may be presented as follows :--

(*a*) That increase by inheritance is a slow process.

(*b*) That " breed " is the factor in high egg-production.

(*c*) That the super-layers (that is, hens laying a very large number of eggs) have been the discovery of single-pen testing or trap nesting rather than the result of any deliberate aim at breeding such hens, and that we fail to produce super-layers in such numbers as will materially increase average laying.

(*d*) That, while full weight must be attached to the old adage that " blood will tell," we have not so far succeeded in very largely increasing the known averages of the White Leghorn breed upon which so many of our commercial poultry farms depend.

(*e*) That the tendency of all abnormality in productivity is followed by reversion to the average production of the breed.

Far from desiring to deprecate breeding for greater egg-production, I would call attention to what appears to me to be the true position with regard to high egg-production and the influence of breed averages upon competition results. The fact is that many who are directing all their resources to breeding for high production are actually losing ground in their flock averages. I have repeatedly stated that a 12-dozen flock average

s attainable on the average farm, and as an outcome of a breed average only, and without regard to high individual performances. Yet I am repeatedly told that many cannot attain that average. It is my conviction that if such cases could be sifted it would be found that poor rearing results and indifferent or inexperienced management of the hens are the main factors contributing to the low averages.

Certainly such flock averages were made many years ago. If they are not obtainable to-day where is our boasted increased egg-production ?

Let us still keep the goal of breeding for high production in view, but let it not obscure the other factors, which are equally important. I believe if half the effort put forth by the average poultry farmer for higher production per medium of inheritance were devoted to better management and more thoughtful care of the whole flock it would bear immediate fruit.

My object in putting the above facts forward is to induce a saner outlook on these matters, because I am convinced that the false views held by many are inimical to sound progress and a right understanding of the main factors in poultry farming.

A Striking Object Lesson.

Results illustrating in a striking manner the value of an early ploughing of the land after a crop has been removed are supplied by Mr. John Alcock, Webheath, Mogilla (South Coast), from an experiment carried out by him on his own land.

During 1922 a crop of oats sown in February was grazed off in July and August

Plot 1 was ploughed on 25th September. The condition of the ground was very moist, and stubble about a foot high was ploughed under.

Plot 2 was ploughed on 15th November. The ground was not so moist, and stubble of a few inches was ploughed in.

Plot 3 was ploughed on 25th November. The ground was very dry and there was no stubble growth.

Maize (Hickory King) was sown for fodder on the three plots on 1st December, 1922. I saw these plots in February, 1923, and there seemed to be a very great difference in their growth. Mr. Alcock kindly consented to have the yields taken, and this operation was supervised by Mr. J. R. Boller, Secretary of the Bimbaya branch of the Agricultural Bureau, who forwarded me the weights of each.

Plot 1	yielded	14 tons 1 cwt	of green fodder per acre.
Plot 2	,,	7 tons 11 cwt	,, ,, ,,
Plot 3	,,	4 tons 6 cwt.	,, ,, ,,

These results (to which the green manuring probably contributed) show even more marked differences in favour of early ploughing than the Department has been obtaining in its experiments, and having been carried out by a farmer on his own land, they should be sufficiently convincing to have an important influence for good on the agricultural practice of the district and of other districts in the State.—H. Wenholz, Special Agricultural Instructor.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Growers who have crops suitable for seed purposes are invited to communicate with the Department of Agriculture, Sydney. This should be done in ample time to allow of an inspection of the crop to be made before harvesting.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Maize (varieties in order of maturity):—	
Sundown	J. S. Whan, Llangothlin.
Wellingrove ...	Manager, Experiment Farm, Glen Innes
Golden Superb	W. H. McMahon, Pola Creek, Macleay River.
Iowa Silvermine ...	J. Morphett, Farm 863, Stanbridge, *via* Leeton.
Funk's Yellow Dent ...	T. C. Weedon, Beverley, South Gundagai
	J. R. Knapp, Bolong, *via* Nowra.
	L. B. Garrad, Milton.
	A. E. Brown, Mt. Keira.
Craig Mitchell	K. W. D. Humphries, Muswellbrook.
Coodra Vale ...	R. S. Lindeman, Coodra Station, Wee Jasper, *via* Yass.
Hickory King ...	J. W. Henry, Bolong, *via* Nowra.
Leaming	Manager, Experiment Farm, Grafton.
	W. Ryan, Oxley Island, Manning River
	E. W. Alway, Jones Island, Manning River
Manning Silvermine ...	W. J. Adams, Dumaresq Island, Manning River.
Golden Beauty	R. Richardson, Tinonee, Manning River
	A. M. Hooke, Kootingal, Taree
Early Clarence	F. T. Dowling, Tumut.
Fitzroy ...	Manager, Experiment Farm, Grafton
	F. Waters, East Kempsey
	G. P. Collins, Fairy Hill, Casino.
	J. P. Mooney, Taree.
Large Red Hogan ...	G. Levick, Taree Estate, Taree
Grain Sorghum:—	
Feterita	Manager, Experiment Farm, Coonamble
Manchu Kaoliang	Manager, Experiment Farm, Bathurst
Dwarf Kafir	P. A. R. Gersbach, Leeton.
White Yolo	P. A. R. Gersbach, Leeton.
Sweet Sorghum:—	
Early Amber Cane	Manager, Experiment Farm, Bathurst
Selection No. 61	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Berry.
Selection No. 34	Manager, Experiment Farm, Yanco.
Saccaline...	Manager, Experiment Farm, Berry.
Potatoes:—	
Satisfaction	H. F. White, Bald Blair, Guyra.
	G. H. J. Price, Yarrowyck-road, Armidale.
Symington	H. F. White, Bald Blair, Guyra.
Millet:—	
Japanese	Manager, Experiment Farm, Coonamble.
Lucerne:—	
	W. E. Myring & Sons, "Nungaroi," Pallamallawa.
	A. L. Thomas, "Merrivale," Bedgerebong, *via* Forbes.

Shearman's Clover (Roots):—	J. H. Shearman, Fullerton Cove, *via* Newcastle.
Peanuts:—	
Valencia	S. Broom, Farm 1298, Griffith.
Chinese	S. Broom, Farm 1298, Griffith.
White Spanish	S. Broom, Farm 1298, Griffith.
Grasses:—	
Elephant Grass (Roots) ...	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Yanco.
	Principal, H. A. College, Richmond.
Kikuyu Grass (Roots)	Principal H. A. College, Richmond.
	Manager, Experiment Farm, Yanco.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm Glen Innes.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

Early Spring Work in the Apiary.

Bees will be showing signs of activity this month in the majority of districts, and bee-farmers must keep in mind the two essential points in early spring management, namely, stores and comfortable conditions. A surplus of stores must be on hand to induce brood raising, and the colonies should be kept snug to allow of the best results. The question of keeping the colonies warm does not apply so much to hives with a large cluster, but in a season such as this—a season, that is, following a poor one—it is very desirable that the weaker stocks (of which there are usually a good number) should be made comfortable. Where only a few combs are occupied in the hive, it is usually an advantage to place packing on each side of the cluster.—W. A. Goodacre, Senior Apiary Instructor.

Farmers and Farm Workers from Great Britain.

Attention is drawn to the fact that the Government has approved of the extension of facilities for persons resident in New South Wales to nominate relatives and friends for assisted passages from the United Kingdom. Up till recently the privilege was only available to close relatives, but any person for whom employment can be guaranteed may now be nominated. Churches and similar organised bodies may also effect nominations in favour of persons or families to be selected by their representatives in Great Britain.

The cost of the passages is £22 for each person over 12 years of age, half this amount being charged for children between 3 and 12 years, and this may accompany either the application for nomination or be paid by the nominees in London.

In addition to the introduction of new settlers under the nomination system, the Government is bringing to the State every month numbers of youths for farm work, and as a result lads either with or without experience can be made available to farmers needing assistance.

The Director of Immigration will supply further particulars upon receipt of request addressed to 78 Elizabeth-street, Sydney.

Bee-keeping in Relation to Fruit-growing.

H. GRAHAM SMITH, Apiarist, Hawkesbury Agricultural College.

THE value of bees to the fruit-grower is something that is not fully appreciated by many engaged in that industry. The reasons for this are various. Some have the idea that the keeping of bees in the vicinity of a farmyard is likely to give trouble; others, that they are not essential for the insurance of a good setting of fruit, since wind and other agencies perform the function of fertilising the blossoms. It must, however, be remembered that bees are numerous in the spring when their services are so greatly needed. Wasps, butterflies, and other insects are scarce at that time and visit flowers chiefly for their individual sustenance, while bees visit the same flowers again and again. As the production of fruit is dependent upon the conveyance of pollen grains from bloom to bloom (whether different individuals of the same or of different varieties of the same species), bees, in seeking sustenance for themselves and the thousands of hungry mouths at home, perform an important function, and we accept it as a law in nature that they were formed as much for one purpose as the other.

The value of the honey crop in the United States for the year 1922 is estimated at twenty million dollars, and in a recent report of a reliable authority, it has been conservatively estimated that bees are more valuable to agriculture in the United States in performing the work of cross pollination that they are as honey producers. In parts of California extensive orchardists pay a rental to bee-keepers for the use of their bees during the blossoming period. We have no record of this having been done in Australia, but some orchardists have granted a beekeeper a free apiary site in return for the use of his bees.

No definite number of colonies can be mentioned, but one to three per acre of orchard should show a material increase in quantity and quality of fruit. In one of this State's noted citrus districts it has been calculated that, according to the number of registered apiaries, the number of colonies of bees is not more than one in every ten orchards. In such circumstances the potential annual loss to the orchardists must be very considerable.

How and When to Begin.

The most suitable time for an orchardist to establish a small apiary would be during the spring or early summer. There are various ways in which this may be done, but one occupying a minimum of time should be considered even at a little extra expense. Fully established colonies may be purchased, which are ready for placing on their permanent stands and which require little in

the way of immediate attention. If the purchase be made from a reliable bee-keeper, the colonies may be regarded as healthy, but precaution is necessary when buying up colonies indiscriminately. Another method of establishing an apiary is to prepare hives (factory-made for preference) by nailing, painting, and fitting with comb-foundation, and then to purchase prime swarms from a neighbouring bee-keeper when swarming is prevalent. Occasionally a swarm will be found hanging on a fruit tree, and, if given a home will pay the rent and something more. As it is natural for bees to swarm, in the course of a year the number of colonies may be doubled. Swarming, however, may be controlled or practically prevented altogether as desired.

The Site and Equipment.

The site upon which the apiary is placed need not be in the orchard. A small allotment of ground may be selected where bees are not likely to be disturbed when cultivating. The land should be fairly level, well drained, and for preference the hives should face the north-east. A trellis of passion vines around the plot makes an ideal windbreak, and affords protection to the hives both in summer and winter.

The equipment required for the running of a small apiary is neither extensive nor costly. The requisites are mostly standardised throughout Australia, which is an advantage. The Langstroth ten-frame hive may be purchased in lots of five with supers at a reduction in price. A smoker, hive tool, veil, uncapping knife, and honey extractor are among the other requisites. In one case the first year's honey from two colonies was sufficient to purchase a complete outfit, and to leave the owner with a balance in hand.

Subsequent Attention.

As a subsidiary industry to orcharding, bee-keeping is one of the most suitable, since the hives do not require daily attention. There are times when prompt attention is necessary, as during swarming or when additional super space is required. It is also necessary for the beginner to understand his bees, to study the order of the hive within, and to get generally acquainted with their traits under certain conditions. Farmers' Bulletin No. 129, entitled "The Beginner in Bee-culture," procurable from the Department of Agriculture or the Government Printer for tenpence, post free, gives all the necessary instructions regarding the handling of frames, control of colonies under various conditions, and answers most of the questions that present themselves to the uninitiated. Many of the most successful bee-keepers started with a single colony, and have grown in knowledge as their colonies have grown in numbers.

Viewing the addition of a small apiary from another angle, sufficient honey and beeswax will at ordinary times be produced to enable a surplus to be marketed, and the home table may always be adorned by a dish of one of the most wholesome foods nature produces.

Bee-keepers in Conference

W. A. GOODACRE, Senior Apiary Instructor.

THERE was a representative attendance of bee-keepers at the recent conference of apiarists in Victoria. One of the chief topics discussed in that State is migratory bee-farming, and it is surprising to what extent this work has been developed.

Bees are removed long distances by motor or rail to catch a honey flow in another district, and from all accounts this removal of the bees pays, and pays well. In New South Wales, although we have advocated the practice of migratory bee-farming, the general method is to stay at home and put more trust in providence. Ultimately, no doubt, somebody will make a move and others will see the advantage of the migratory method. The apiarist's knowledge of favourable localities is remarkably extended through this type of bee-farming. We find bee-keepers in Victoria questioning one another about prospects from 50 to 100 miles away from home.

The problem of the honey market is more acute in Victoria than here. In New South Wales we already have some organisation to assist us, but in Victoria a beginning has only just been made. This question of organisation in other States affects us considerably, for we cannot hope to develop the local industry to the best advantage until some control over inter-state traffic in honey has been obtained. If only one or two States become so organised that fair prices for honey are assured, they will inevitably become a dumping ground for produce from unorganised parts, and it is doubtful whether any organisation can withstand such dumping without breaking down. We should give every encouragement, and assistance if necessary, to other States endeavouring to organise their marketing business. Formation of a "ring" for the extortion of fancy prices is not the bee-keeper's objective, but it must be his business to obtain for his product a price commensurate with the cost of its production, and only by organisation will he find this possible.

At the New South Wales Apiarists' Conference Mr. Blackett suggested the organisation of the industry on the basis of subdivision of the State into a number of districts. To each of these could be appointed a district officer as supervisor, with power to appoint persons in the different sections of his territory to organise such sections thoroughly. If by this means there could be obtained a good estimate of the produce held, and some control over it in its dispatch to market, the trouble of organisation would be well repaid.

Conferences so successful as those referred to augur well for the industry, for they are significant of a fine spirit, considering the poorness of the season. It is by this spirit only that successful organisation of the industry will become possible.

E

Orchard Notes.

August.

W. J. ALLEN and W. LE GAY BRERETON.

THE pruning of most varieties of apples and pears, and even the late starting varieties of stone fruits, especially in late districts, can be continued this month.

The winter ploughing should have been completed by the end of last month, but if any delay occurred every effort should now be made to complete it, in order to lock in the moisture that has already been received and so that the soil may be in a condition to absorb any further falls before the spring, and also to give time for any organic matter that has been turned under to rot.

Though it is preferable to plant deciduous trees earlier, in a great many cases the work has been delayed this season owing to the dry conditions, and planting can be continued this month with any varieties that have not commenced to shoot.

In districts that have an early spring free from frost, citrus trees can be put out, but where frost is liable to occur planting should be delayed till the frosts are over.

If it has not already been done, there is still time to spray for the prevention of peach leaf curl those varieties of peach trees that have not yet commenced to shoot. Lime-sulphur (winter strength) or Bordeaux mixture, 6-4-40, may be used.

Lime-sulphur (winter strength) gives a better kill of San José scale on deciduous fruit trees when applied late, but for safety it should not be used later than when the buds have swollen. That is also the latest period at which it is advisable to apply miscible spraying oils at winter strength for various scale pests or woolly aphis. The miscible spraying oils applied as stated above are also effective in controlling the green peach aphis.

The black peach aphis is not so easily controlled, but should any be showing on the trees before they start to shoot such an application of oil will, of course, kill them, or if oil is not being applied tobacco wash can be added to the lime-sulphur spray. Unfortunately, it is generally necessary to follow up with other applications of tobacco spray later in the spring for this pest.

In many of the grape-vine districts it will be necessary to make a start on the dormant swab this month for black spot. A leaflet, with full directions for preparing and applying the above-mentioned spray, can be had on application.

Where citrus trees have not already received their spring dressing of fertilisers it is a good time to apply them, except sulphate of ammonia or nitrate of soda, which leach out very easily and which should be applied later during September.

The latter part of the winter has been exceptionally cold and frosty, and care will have to be taken that Washington Navel oranges and Emperor mandarins do not hang too long, as under such conditions they are liable to become too puffy and dry.

With a view of extending the canning season into the gap between the early peaches and apricots, tests were made at the Leeton cannery during the past season with a consignment of Leader freestone peaches which had been grown on the area for experimental purposes. This peach matures earlier than the Tuscan and the Levis, and has been favourably commented upon by American experts The tests carried out at the local factory proved that the Leader peach is not, generally speaking, a satisfactory canner, having the same tendency as other freestones to prove soft in patches, and it is desired to correct any impression among growers that this peach is a desirable variety to plant from a canning point of view.

Unit Values of Fertilising Materials.

The unit values of fertilising ingredients in different manures for 1923 are as follows:—

	per unit.
Nitrogen in nitrates	26s. 3d.
,, ammonium salts	18s. 7d.
,, blood, bones, offal, &c. . .	17s. 7d.
Phosphoric acid in bones, offal, &c.	4s. 8d.
,, (water soluble) in superphosphate ..	7s. 2d.
Potash in muriate of potash...	6s. 8d.
,, sulphate of potash	7s. 6d.

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bonedust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid:—

4 × 17s. 7d. = £3 10s 4d. = value of the nitrogen per ton.
20 × 4s. 8d. = £4 13s. 4d. = ,, phosphoric acid per ton.

£8 3s 8d. = value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions; neither does it represent the costs incurred by the manufacturer in the preparation, such as cost of mixing, bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail value of the manurial ingredients, and it will be found in the majority of cases the price asked and the value assigned are fairly close.—A. A. Ramsay, Chemist.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date
Parkes P. A. and H. Association	L. S. Seaborn	Aug. 14, 15
Forbes P. A. and H. Association	W. T. Gilchrist	,, 20, 21, 22
Corowa P. A. and H. Society	J. D. Fraser	,, 21, 22
Grenfell P. A. and H. Association	G. Cousins	,, 28, 29
Murrumbidgee P. and A. Association (Wagga)	F. H. Croaker	,, 28, 29, 30
Culcairn P. A. H. and I. Society	L. H. M. Newton	Sept. 4, 5
Manildra P. and A. Society	I. C. Longley	,, 5
Young P. and A. Association	T. A. Tester	,, 4, 5, 6
Junee P. A. and I. Association	T. C. Humphrys	,, 6, 7
Cowra P. A. and H. Association	E. P. Todhunter	,, 11, 12
Cootamundra A. P. H. and I. Association	W. W. Brunton	,, 11, 12
Narandera P. and A. Association	W. H. Canton	,, 11, 12
Gunnedah P. A. and H. Association	M. C. Tweedie	,, 11, 12, 13
Barmedman A. and H. Society	A. J. Meagher	,, 12
Murrumburrah P. A. and I. Association	W. Worner	,, 13, 14
Holbrook P. A. and H. Society	J. S. Stewart	,, 18, 19
Ganmain A. and P. Association	A. R. Lhuede	,, 18, 19
Canowindra P. A. and H. Association	J. T. Rule	,, 18, 19
Temora P. A. H. and I. Association	A. D. Ness	,, 18, 19, 20
Boorowa P. A. and H. Association	W. Burns	,, 20, 21
Northern A. Association (Singleton)	J. T. McMahon	,, 20, 21, 22
Henty P. and A. Society	H. Wehrman	,, 25, 26
West Wyalong P. A. H. and I. Association	T. A. Smith	,, 25, 26, 27
Hay P. and A. Association	C. L. Lincolne	,, 26, 27
Koorawatha A. Society	J. A. Larson	Oct. 2
Ardlethan A. Society	R. Neill	,, 3
Walbundrie P. A. and H. Society	W. Goldsworthy	,, 3
Ariah Park A. Society	J. F. McInnes	,, 10
Deniliquin P. and A. Society	P. Fagan	,, 17
Griffith A. Society	M. E. Sellin	,, 17, 18
Lismore A. and I. Society	H. Pritchard	Nov. 20, 21, 22

1924.

Society.	Secretary.	Date
Albion Park A. and H. Association	H. R. Hobart	Jan. 11, 12
Dapto A. and H. Society	E. G. Coghlan	,, 18, 19
Wollongong A. H. and I. Association	W. J. Cochrane	,, 31 to Feb. 2
Guyra P. A. and H. Association	P. N. Stevenson	Feb. 19, 20, 21
Nepean District A. H. and I. Society	C. H. Fulton	,, 21, 22, 23
Moruya A. and P. Society	H. P. Jeffery	,, 27, 28
Newcastle A. H. and I. Association	E. J. Dann	,, 26 to Mar. 1
Manning River A. and H. Association (Taree)	R. Plummer	Mar. 4, 5, 6
Berrima A. H. and I. Society	W. Holt	,, 6, 7, 8
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	,, 11, 12, 13
Mudgee A. P. H. and I. Association	J. H. Shaw	,, 11, 12, 13
Hunter River A. and H. Society (West Maitland)	J. S. Hoskins	,, 12 to 15
Crookwell A. P. and H. Society	C. H. Levy	,, 20, 21
Tamworth P. and A. Association	F. G. Callaghan	,, 25, 26, 27
Narrabri P. A. and H. Association	E. J. Kimmorley	,, 26, 27
Campbelltown A. Society	J. T. Deane	,, 28, 29
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 9, 10, 11
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 14 to 23

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Agricultural Gazette of New South Wales.

Conservation of Fodder.

SILAGE FOR THE DAIRY FARMER.

A. H. E. McDONALD, Chief Inspector of Agriculture, and A. BROOKS, Works Superintendent.

IN one form and another the silo dates back to antiquity, but it was not until the "nineties" that this method of conserving fodder really attracted any attention in Australia. To the first Principal of Hawkesbury Agricultural College belongs the credit of first bringing under the notice of the dairy farmers of New South Wales the many advantages of silage as a means of increasing their profits.

At that time cost was as great a stumbling block as it is to-day, although both materials and labour were much cheaper, and it was possible to build overhead silos at 15s. to 20s. per ton capacity, as against 40s. to 70s. to-day. Among those who have built silos there are very few, if any, who have regretted the expenditure; in fact, some very hard-headed dairy farmers say they have easily doubled the carrying capacity of their farms by feeding ensilage.

The idea prevailed until recent years that, owing to the strong fermented flavour of the silage itself, a taint would be conveyed to the milk and cream. It has been conclusively shown, however, that good, properly prepared silage does not impart any harmful flavour to the milk. The cows soon acquire a taste for silage and become very fond of it.

Last month some account was given in these pages of the conservation of silage in pits—a method that is particularly adapted to the requirements of the wheat farmer, though also quite suitable for dairy farmers in certain districts, and it is thought some suggestions about the construction of overhead silos and their manipulation and management will be useful.

The Limitations of Pasturing.

Pasturing is no doubt the easiest method of feeding a herd, but it is within the mark to say there is hardly a single district in the State where that can be done all the year round. It is just here that the silo comes in, for it is an undoubted insurance of a continuity of good food, and consequently of a regular milk supply, and it also makes it possible to carry on operations on a smaller area, and therefore at lower rental charges.

The productive capacity of most dairy farms is limited principally by the pasturage available during the coldest months—indeed, in the main dairying districts there is invariably a shortage at that time. On the North Coast, paspalum has taken possession of the best dairying lands, and being a summer grass it makes no growth in the late autumn and winter months,

while its aggressive habit in the summer prevents other plants that might provide feed in the winter from living in association with it. On the South Coast the cold is sufficient in the winter to prevent pastures from making much growth.

Notwithstanding these limiting factors of the cooler months, the number of cows on many farms is as many as the pastures will support during the summer, and the stock consequently have a hard time during the winter and losses frequently occur, while even where the animals do not actually die they become so reduced in condition that when spring returns they do not readily respond to the growth of grass, and it may be six to eight weeks before they come to their full flow of milk. Production is thus seriously reduced during some of the best months of the year.

More careful farmers help their stock through the winter to some extent by keeping the number below the maximum summer capacity of the farm, and thus allow the grass to make a growth which will carry the cattle through the winter. This is not economical, however, as it prevents the best use being made of the grass during the summer, and the rough pasturage that is obtained for the winter is not after all of much value.

Many farmers take advantage of the fact that cultivation forces the land to yield a great deal more greenstuff per acre than can be obtained from pasture, but even these crops do not yield at a time when feed is otherwise short. With a silo, crops can be grown at the time of the year when they yield their heaviest, and the material can be conserved in its best and most succulent condition until it is needed. The carrying capacity of the farm may therefore be increased in the summer with the confidence that the stock will be kept in good condition during the winter ready to respond at once to the improvement of the grass in the spring.

The Recommendations of Silage.

A consideration that must weigh heavily in favour of silage is the insurance it offers against the loss of valuable cows during a hard winter or a drought. Dairy herds that have taken years to build up are worth a great deal, and the numbers and the standard of a herd cannot be easily recovered when a drought ends. If losses occur periodically, the rate of improvement in the herd is very slow indeed, as the ground lost during one drought has probably hardly been regained when another period of scarcity comes along. It is the best cows that generally go off first if feed is scarce, as, owing to their high-producing disposition, they keep low in condition, while the poor yielders keep themselves in condition by using the feed to build up flesh and strength instead of making milk.

An ensiled crop is preserved in its green state, and it is therefore an excellent substitute for green grass. The succulence of the green crop is preserved and stimulates the milk flow, whereas dry feed tends to reduce it. Moreover, it is a convenient means of conserving fodder in the dairying districts.

On the coast the crops that give the largest yields of good forage are maize and sorghum, but neither can be converted into good hay, whereas both make excellent silage. Weather conditions, too, may be unfavourable to the making of hay, but they never interfere with the making of silage.

While the foregoing advantages of silage have been presented from the point of view of the coastal dairy farmer, its general value as a feed thoroughly justifies the making of it in all districts where dairying is practised. In many of the drier western districts the making of silage as a regular feature of operations would enable dairying to be carried on much more extensively and very profitably. There are extensive areas of alluvial soils adjoining permanent water, like the McIntyre, Gwydir, Namoi, Castlereagh, Macquarie, Lachlan, and Murrumbidgee rivers, which produce splendid pasturage for dairy cows when the rainfall is favourable, while affording ideal conditions for the growth of heavy crops of maize, wheat, &c., which could be turned into silage to maintain the flow of milk at times when the pastures go off.

Apart from the alluvial flats mentioned, extensive areas of rich basaltic soil also exist in many inland districts, especially in the north-west, which are somewhat similar in their utility for grazing and for the growth of crops that can be ensiled. A feature of these rich areas is the wonderfully nourishing quality of the pasturage. While green it has great milk-producing qualities, and when dry is very fattening, though not so satisfactory in relation to milk yield— a limitation that can easily be got over, however, for silage in conjunction with dry pastures makes a ration that will maintain a normal flow of milk.

In many of these districts dairying is already carried on to a limited extent, but, owing to the rather frequent periods of shortage of green feed, the average annual return per cow is comparatively small, and the industry does not therefore develop to any great extent.

The adoption of the system we are here advocating would ensure continuity of a supply of succulent green feed and enable a very profitable industry to be established on large areas that, owing to their great fertility, cannot be profitably used for the production of the wheat which is mainly grown in those parts of the State. It would make small holdings profitable and lead to greater and more general prosperity.

Silage Saves the Farmer from Bankruptcy.

Competition under modern conditions has become so keen that no one can afford to take risks that may involve him in heavy losses. When land and stock were cheap the loss of a year's revenue, and even of a considerable part of the herd, were not so disastrous as nowadays when there are few farmers who are not in the position of having to meet heavy interest or rental charges, and none who do not have to pay high prices for all the commodities they use. It is hard enough to make the books balance when rain falls fairly regularly and the grass grows about as fast as the cows can

eat it; but when for months there is no rain or the weather is so cold that the grass will not grow and production ceases, though the expenses continue, a burden is imposed upon the farmer that is only worked off with difficulty when the conditions return to normal.

It is no use blaming the managers of financial institutions for insisting that interest and rent must be paid. They act in the capacity of trustees for other people's money, and are there to see that these charges are met on the due date, and they can only extend consideration to farmers who endeavour to ensure themselves against loss by adopting sound methods of farm management. Among such farmers are those who conserve feed in the form of silage—with this reservation, however, that the farmer who adopts the practice will soon put himself in a sound financial and independent position.

Crops Suitable for Silage.

While many crops can be used for filling the silo, the most suitable in regard to feeding value and ease of handling are maize, sorghum, Sudan grass, wheat, oats, and barley. In the coastal districts maize and sorghum are undoubtedly the best, as they give a big yield per acre and are very easily converted into silage. Maize is the better of the two, being less subject to disease and producing fodder of higher quality. As a rule the best crops for inland districts are wheat, oats, and barley, although in some localities, particularly in the north-west, maize is quite satisfactory. On the whole, however, for western districts preference may be given to the winter cereals, as the yield is more certain. There is not the slightest difficulty about making silage from any of these crops, provided the silo is of the right type, and the crop is cut at the right stage, and also that it is put into the silo immediately and is well packed down during the process.

When and How to Cut Crops.

To produce good silage for dairy cows the crop should be cut when it contains the maximum food nutrients in a condition that will make good silage.

Maize should be cut when the grain is glazed or well-dented, the lower leaves on the stalk yellowing, but the stalk itself full of sap. At this stage it will contain maximum food value, and at the same time sufficient moisture to pack well in the silo.

Sorghum should be cut when the heads are reaching maturity, and the seeds so hard that they are crushed between the finger and thumb with difficulty. Sudan grass should be cut when the seed is formed but is still in the milk stage.

Wheat, oats, and barley should be cut just after the ears are well out. Many farmers before cutting these crops for hay wait until the grain is well formed and the straw has become somewhat dry. Crops intended for silage should not be allowed to reach this stage, as plenty of sap is required in the plant to ensure a good product when the silo is opened up.

Maize and sorghum can be cut with the least labour with the maize harvester, but where that implement is not available, cane knives, short hoes, reaping hooks, or scrub scythes may be used. A slide fitted with a scrub scythe blade and drawn by a horse is used by some farmers.

Wheat, oats, and barley are cut with the reaper and binder.

Unlike hay, silage may be made at any time, irrespective of the weather. Rain causes inconvenience, but it need not delay the work.

Cart in without Loss of Time.

An essential point in making good silage is that the material should be put in the silo in a succulent condition—no drying out should be allowed. Cut the material and put into the silo the same day; teams should be carting from the harvester to the silo.

Slides are very useful for hauling the crop to the silo, especially as the material has not to be lifted to any height.

All crops must be chaffed before being put into the silo to ensure close packing and to prevent fermentation. The pieces should be cut to about a ½ inch in length. The chaffing can be done either with a silage cutter fitted with a blower for filling the silo, or with an ordinary chaffcutter with a chain elevator. The former equipment is useful when large quantities are being handled, but for the ordinary-sized farm a chaffcutter with an elevator is, on the whole, more satisfactory, as it requires less power and fewer men to operate it, and the knives are easier to sharpen. These chaffcutters are generally made with 9-inch, 10-inch, or 12-inch mouths. Any one of these is satisfactory, but the smaller ones, of course, will not handle the crops so quickly as the 12-inch machine. Chain elevators can be easily fitted to almost any chaffcutter.

When silage cutters are used a fairly high-powered engine is required, but a 4 or 5 h.p. engine will drive a chaffcutter.

Filling the Silo.

Mr. E. A. Southee, Principal of Hawkesbury Agricultural College, in a paper on silage-making draws attention to the importance of properly packing the material in the silo. When not properly packed or sufficiently tramped to exclude air, spoiled silage results. It is a well known fact that the more the material is tramped in the filling process, the less it settles afterwards.

When the material settles in the silo, it tends to draw away from the walls, leaving an air space, which results in spoiled silage. The best method is to build the material up about 2 feet around the walls and sloping to the centre, and to trample this down well: then fill the centre up and tramp it around the walls equally: then again build up around the walls, and so on. By this means silage will settle without pulling away from the walls. At the top the silage is rounded off by being made higher in the centre, and within a

few days it will settle till nearly level. Tramping is more important in the upper half and top of the silo, because this silage has less weight bearing on it to force it down.

Feeding Silage to Dairy Cows.

Mr. Southee points out that the system of feeding to be adopted must be decided by the farmer, but once the reserve is opened up a little should be taken off the whole of the surface daily, or the top material will turn sour. Feeding with silage can, if necessary, start quite shortly after the material has been put in the silo.

Maize or sorghum silage is best fed with lucerne hay at the daily rate of 3 lb. silage and 1 lb. lucerne-hay for each 100-lb. body weight of the cow.

Concentrates may be added to the ration, a mixture being preferable to a single concentrate. Cracked or crushed grain, bran, pollard, linseed meal, and copra cake are suitable for this purpose. A concentrate mixture may be fed according to the yield of the cow and the amount of pasture available. Under bad winter conditions a full daily ration would be completed by adding to the silage and hay 1 lb. of a concentrate for each—

3 lb. of Jersey milk produced per day.
3½ lb. of Shorthorn milk produced per day.
4 lb. of Holstein milk produced per day.
1 lb. of butter-fat produced per week.

Thus a full ration for a Shorthorn cow weighing 1,100 lb. and producing 21 lb. of milk per day would be :—

33 lb. silage.
11 lb. lucerne hay.
6 lb. concentrates.

At Hawkesbury Agricultural College it is found that the following make good mixtures :—

For Winter—	lb.
Maize ensilage	25
Green barley	10
Lucerne chaff	6
Cocoanut oil cake	2
Linseed meal	1½
Bran	3

If green barley is not available, 30 lb. of maize ensilage and 10 lb. of lucerne hay may be given.

For Summer—	lb.
Maize ensilage	25
Green maize	25
Lucerne hay	10
Bran	2
Linseed meal	2

Oaten and wheaten chaff can also be fed in conjunction with silage, but more concentrates should be used.

The only care to be taken in feeding silage is not to overfeed bulls. Excess feeding of silage to bulls tends to develop a " pot " belly, and thus affects their potency. The maximum amount that a bull should receive is 15 lb. a day.

The average quantity of silage consumed per cow at the College during the winter months is 30 lb. per day.

Farmers frequently ask if silage is equal in feeding value to green grass, and it must be said at once that it is not equal to an ordinary mixed pasturage, though it is a very good substitute. Mixed pasture, on a fairly good soil, is almost ideal feed, as it is made up of many kinds of true grasses, legumes, and other herbs. It is therefore fairly well balanced in regard to protein and carbohydrates, and is also extremely palatable, which is an important feature. Pastures made up entirely of one kind of grass, such as those of the coast where paspalum has possession, are not entirely satisfactory owing to the lack of variety.

As a rule, silage is made from one crop only—generally either maize, sorghum, or winter cereals, and as these are weak in protein the silage is somewhat deficient in that very important food constituent. For this reason it has been found economical to add the concentrates mentioned in the mixtures fed at Hawkesbury Agricultural College.

Silage will maintain stock in good condition without the admixture of other feeds, but much better results are obtained by using with it such stuffs as bran, pollard, oilcake, or lucerne hay.

The Construction of Overhead Silos.

In view of the necessity for the exclusion of air in making silage, it is essential that the walls of the overhead silo shall be airtight and as high as possible consistent with general convenience. In a high silo the silage becomes very compact, by reason of its own weight, and thus excludes air. In the early days of silo construction in this State some so-called silos were built from 8 feet to 15 feet high, the latter being considered a deep silo, but unless there was considerable weight placed on the top of the material there was much loss in such structures.

In the silo that is built to-day, no weighting is necessary owing to the height of the silo, and the only waste that should occur is a little on the top, and even that might be saved if the material is covered over when filling is finished. Another advantage of the high silo is that the fodder packs more closely together and more weight per cubic foot of silage is obtained, while the storage capacity of the silo is made better use of.

The height should be twice the diameter, and to reduce the actual height overground at least 5 feet may be sunk below the ground level. The walls must be smoo th and perpendicular in order to allow the mass to settle without forming cavities or air pockets, and they must be very rigid and strong so a not to spring when the silage settles, for the outward pressure is very

considerable and increases with the depth of the silo per square foot of surface. Because of this lateral pressure it is difficult to make rectangular silos deep enough to be economical, as the walls of a silo so shaped spring more than those of the circular or octagonal shapes. It is for this reason that the circular silo is so much favoured.

The Size of the Silo.

As silage should be fed each day at the rate of not less than 2 inches deep over the whole surface of the fodder, and if possible 3 inches—so that the surface shall not mould before it is fed to the stock the rate at which the silage is likely to be consumed has a close relation to the size of the silo. For a herd of thirty cows the silo should be 15 feet in diameter and 30 feet deep; such a structure will hold feed for 180 days, calculated at the rate of 35 to 40 lb. per cow daily. For larger herds it is better to erect additional silos rather than larger ones.

(*To be continued*)

How to Make a Hotbed.

The first requisite for the making of a hotbed is a quantity of stable manure. Shake this out loosely—rejecting about a third of the loose droppings, as these are apt to create an unmanageable heat and tend to cool quickly—and throw it into a compact heap to sweat. In four or five days the heap will become very hot, when it should be turned inside out, the material at the same time being shaken and water applied to any portion that is dry. After another interval of three or four days, apply water to the heap, and turn it again, making sure that it is consistently moist. In another four days the material should be ready for use.

A hotbed consists of a properly built heap of such manure surmounted by a shallow frame with a removable sloping glass "light" or cover. For winter forcing, the sides of the heap—which should be built up above the surface of the ground, not set in a depression—should be 4 feet high; for early spring work a height of 3 feet is sufficient. A heap 7 feet long by 5 feet wide will take a wooden frame 6 feet long by 4 feet wide, with a height of 12 inches at the back and 8 inches at the front. The whole should be so arranged that it faces the north.

Not only should the heap of manure be placed upon the surface (not below the surface) of the ground, but the piece of ground chosen should be rather elevated, so that it may be well drained. When building the heap first shake the material evenly a foot deep over the whole of the rectangle to be covered, and tread it evenly down, repeating the process of alternate even spreading and treading until the heap is of the required height. Place the frame in position, and in four days' time thoroughly water the bed and put on the glass cover, when the bed will be ready for use.

The heat which the sun and the manure combine in generating is regulated by tilting the frame or lifting the "light" (the glass cover) to the degree necessary. Careful regulation is necessary, the thickness of a clothes-peg under the light often being quite sufficient. When the heat shows signs of declining fresh manure packed round the frame will tend to maintain the temperature in the centre.—E. N. Ward, Superintendent, Sydney Botanic Gardens.

Farmers' Experiment Plots.

Potato Experiments, 1922–23.

New England District.

M. H. REYNOLDS, Senior Agricultural Instructor.

POTATO trials were carried out during the season 1922-23 in co-operation with the following farmers:

J. S. Whan, Llangothlin.
J. Piper, jun., Llangothlin.
J. Jay and R. Hollow, Ben Lomond.
J. Hill, Guyra
J. Price, Armidale.
W. Challis, Kentucky.
J. W. Webster, Glen Innes.
V. Cornish, Red Range.
E. Scott, Red Range.
G. Handibo, Black Mountain.

The season was not favourable to potato-growing, due, in the main, to deficient rainfall over the period January to March. Potato moth caused a considerable amount of injury to the crops sown early and mid-season, and only in exceptional cases did they escape damage. The late-sown crops were less seriously affected. The excessive rainfall in December also caused damage, mainly on low-lying or level lands; and frosts (as early as January) affected crops in similar situations. In two instances where there was freedom from moth the land had not been utilised for potatoes during the previous two seasons. In a case where the ground adjoining had produced potatoes for two seasons in succession the tubers were damaged by moth grubs. Loss from disease was only slight, except where tubers had been punctured by grubs, fungous diseases being permitted to enter and set up rot. Two, and possibly three, generations of moth occurred this season· but notwithstanding the damage caused there were more potatoes produced than elsewhere in the State. At Red Range, about 13 miles east of Glen Innes, good returns were obtained from well-prepared land, and portion of the area at Llangothlin gave a yield of 8 tons per acre.

About flowering time the potato plant throws out underground stems, portions of which enlarge into the tubers. If, when this occurs, the soil is over-moist, the tubers are generally formed near to the surface, whereas in a well-drained soil, or one lacking moisture in excess, the tubers are formed more deeply in the ground. It is not always essential to hill, of course, for in friable, well-drained soil the tubers may be formed so deeply as not

to need further covering. Where, however, the tubers are formed near the surface and the ground cracks owing to their development, it is well to shallow-cultivate, even after hilling, or when the plants are quite mature, in order that the cracks may be filled and potato moth be prevented from getting down to the tubers to lay eggs.

The plots at Ben Lomond were spoilt by water-logging, and of the trials at Kentucky the results are not available.

RESULTS of Variety Trials.

Variety.	Black Mountain.			Guyra.			Llangothlin (J. S. Whan).			Armidale.			Red Range (V. Cornish).			Glen Innes.		
	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.
Satisfaction..	3	13	3	2	2	2	2	16	1	2	15	1	12	0	0	2	6	1
Early Manistee	4	5	3	...			3	7	0	2	17	3	...			...		
Symington ...	3	2	3	...			5	14	2	2	15	2	10	7	3	2	17	0
Parsons' Seedling	3	0	0	...			5	10	0	2	0	2	...			...		
Early Queen	3	17	2	...			...			2	12	0	...			...		
Grover				...			...			...			...			5	2	2
Elliott's Pink Eye	4	13	3	...			...			4	5	3	11	9	1	2	18	2
Batlow X ...	3	7	2	...			2	7	1	...			...			1	0	3
Red Ruby ...	4	16	1	1	6	0	4	8	1	2	13	0	10	0	0	...		
Dakota Red	4	14	1	...			4	9	2	1	19	1	7	5	3	...		
Factor ..	3	1	0	1	19	0	5	6	2	3	14	0	12	17	1	3	1	1
Redsnooth ...	3	0	2	...			...			2	7	3	...			...		
Surprise ...				1	10	1	4	10	1	1	11	1	9	17	1	3	1	3
Early Manhattan				1	10	0	3	12	2	3	6	0	9	0	0	2	16	1
Coronation ...	..			1	9	0	5	15	0	3	7	1	9	17	1	3	2	2
Queen of the Valley	..			2	3	2	...			...			...			4	3	2
Teasdale ..				0	16	2	5	4	1	0	15	2	10	10	0	...		
Early Rose	...			...			3	4	3	...			...			...		

Fertiliser was not used in the above trials, except at Red Range.

RESULTS of Fertiliser Trials.

Fertiliser per Acre.	Guyra.			Black Mountain.			Llangothlin) (J. Piper, (junior).			Armidale			Glen Innes.			Cost of Fertiliser per Acre.		
	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.	£	s.	d.
*P9, 448 lb....	2	12	2	3	5	1	3	2	0	3	13	3	1	6	2	2	18	6
*M7, 368 lb.	2	5	0	2	15	3	2	8	3	2	16	0	1	7	1	2	3	6
Superphosphate, 280 lb.	2	15	3	2	10	1	2	8	1	2	14	1	1	11	0	0	17	6
Superphosphate and sulphate of ammonia (10 parts to 3 parts), 364 lb.	2	0	0	3	8	2	3	1	2	3	6	0	1	8	0	1	12	6
Sulphate of ammonia, 84 lb.	1	7	2	2	13	0	2	7	1	2	7	3	1	6	2	0	15	0
Chloride of potash, 84 lb.	2	2	2	2	0	0	2	7	1	2	14	2	1	10	1	1	6	0
Special proprietary, 460 lb.	3	3	1	...			...			...			...			...		
Chloride of potash and sulphate of ammonia (equal parts), 168 lb.	2	6	1	2	10	2	2	6	2	2	15	3	1	2	1	2	1	0
No manure ...	2	4	2	2	3	3	2	4	0	2	17	0	1	6	1	...		

* P9 mixture consists of superphosphate 10 parts, chloride of potash 3 parts, and sulphate of ammonia 3 parts. M7 consists of superphosphate 10 parts, chloride of potash 3 parts.

The classification of the potatoes varied at each centre, but, generally speaking, all of 3½ oz. or over were classed as "table." A few tubers that were

very badly affected by moth were not collected, and the few badly affected that were picked up were placed in the seed or rubbish sections. The percentages of table potatoes are shown in the following tables:—

PERCENTAGE of Table Potatoes in Variety Trials.

Locality.	Satisfaction.	Symington.	Parson's Seedling.	Early Queen.	Batlow X.	Red Ruby.	Dakota Red.	Factor.	Surprise.	Early Manhattan.	Coronation.	Queen of the Valley.	Teasdale.	Elliott's Pink Eye.	Early Rose.	Early Manistee.	Grover.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Guyra ..	23·0	...	...	..	.	46·0		19·0	39·4	32·7	29·0	16·8	10·2	...	.	.	..
Black Mountain ...	46·0	78·0	74·0	53·0	62·0	60·0	60·0	46·0	65·0	40·0	32·0	.	...	.	.	..	..
Llangothlin ...	46·0	73·0	72·0	.	56·0	50·0	66·0	45·0	68·0	50·0	47·0	..	38·0		38·0	40·0	..
Armidale ...	32·0	55·0	52·0	24·0	.	38·0	49·0	26·0	54·0	41·0	17·0	..	19·0	22·0	.	...	...
Red Range ...	78·0	89·0	...	...	...	79·0	82·0	78·0	89·0	88·0	72·0	..	85·0	78·0	...	...	..
Glen Innes ...	38·0	62·0	...	...	43·0	...	..	46·0	22·0	43·0	22·0	21·0	...	17·0	...	...	41·0

PERCENTAGE of Table Potatoes in Fertiliser Trials.

Locality.	No Manure.	Special Proprietary.	Chloride of Potash.	Sulphate of Ammonia.	Chloride of Potash and Sulphate of Ammonia.	Superphosphate	Superphosphate and Sulphate of Ammonia.	M 7.	P 0.
	per cent	per cent	per cent.	per cent	per cent.	per cent	per cent	per cent	per cent.
Guyra	26·2	22·0	28·5	25·5	31·7	25·3	26·0	28·0	27·2
Black Mountain ..	46·0	..	42·0	34·0	45·0	45·0	46·0	41·0	43·0
Llangothlin ..	38·0	...	33·0	39·0	40·0	52·0	60·0	34·0	70·0
Armidale	29·0	...	19·0	26·0	21·0	27·0	31·0	16·0	22·0
Glen Innes .	57·0	...	62·0	68·0	77·0	68·0	57·0	65·0	68·0

RAINFALL Records.*

Locality.	October, 1922.	November, 1922.	December, 1922.	January, 1923.	February, 1923.	March. 1923.
Black Mountain	...	231	793	201	45	250
Guyra	...	286	532	175	34	243
Llangothlin	...	237	423	26	18	241
Armidale	...	117	477	223	21	207
Red Range	...	380	575	254	34	...
Glen Innes	158	94	698	237	109	208

* April rainfall is usually beneficial, but it is omitted on account of it being under 100 points and spread over eighteen days.

Notes on the Plots.

J. Piper, jun., Llangothlin (Manurial Trial).—Plots situated on red, loamy soil of ironstone basaltic origin; previous crop oats, 1921, harvested for

hay; land unmanured. Ploughed in July, 5 inches deep, and again just before planting, and harrowed. The varieties used in the trial were Queen of the Valley (which has a long developing period) and Satisfaction. The tubers were planted on 7th November in rows 32 inches apart. The land has been cropped for some years, but the low yields are chiefly attributable to the dry weather in January and February. A striking feature of the results is the benefit from the combination of superphosphate and sulphate of ammonia. It will be noted that the varieties yielded approximately the same from the plots containing this manure. Satisfaction suffered in the greater degree from potato moth.

J. S. Whan, Llangothlin (Variety Trial).—Plots located on undulating slope, soil a red basaltic loam; previous crop potatoes (1921-22); prior to that, pasture. The land was ploughed and harrowed early in June, and the potatoes were planted on 27th October, in moist soil. Mr. Whan reports :—

"Splendid growth was made to the end of December, when the plots suffered from too much rain, which caused rot in some varieties, especially Manhattan and Surprise. The dry hot spell in February caused a ripening-off before they were fully developed of the varieties Satisfaction, Batlow X, Early Rose, Early Manistee, and Early Manhattan. This premature ripening-off occurred in other portions of the district with early-maturing varieties. Late maturing varieties Symington, Parsons' Seedling, Surprise, Dakota Red, and Coronation benefited by the March rains. Excepting Coronation, which had ill-shaped, second-growth tubers, the potatoes were well-formed.

"Rejections on account of moth were very slight, but Batlow X was rather badly affected by scab. On this season's showing, I favour Satisfaction, Factor, and Manhattan for earlies, and for the late crop Symington, Surprise, Parsons' Seedling, and Dakota Red."

Black Mountain.—Plots located on easterly slope of red loam of basaltic origin; previous crop, oats for hay (unmanured); 1920, Manhattan potatoes (unmanured). Land multi-mouldboard ploughed, 4 inches deep, in April, and again in August, and cultivated twice with spring-tooth cultivator before planting. Planted 6th November in drills, 32 inches apart, running the way of the slope, the sets being covered with a one-horse implement.

Potato moth caused damage, two broods apparently operating. The special feature of this trial was the benefit from manuring with a combination of superphosphate (10 parts), and sulphate of ammonia (3 parts), applied in the drills alongside the sets at the rate of 364 lb. per acre; it proved the most profitable, as well as the highest yielding, fertiliser.

Guyra.—Red basaltic country; previous crop, 1921, oats (unmanured) cut for hay. Ploughed 6 inches deep in June, and harrowed twice, early and late, in September. Crop planted on 14th November. When the tubers were cut preparatory to planting a number of the sets (especially of Teasdale

and Red Ruby) failed to sprout. The soil was on the dry side at planting time, although moisture was showing. At this centre no allowance was made for misses, hence the results, especially Red Ruby and Manhattan, are not comparable. Potato moth affected all varieties, especially early maturing sorts. In the manurial trial the improved yields and quality of the potatoes were evidently due to the addition of muriate of potash.

Armidale.—Plots situated on country sloping slightly to the south; red basaltic loam; previous crop, 1921, wheat (unmanured), cut for hay; land not cropped for some years prior to that. Ploughed 8 inches deep in August, and cultivated three times with spring-tooth cultivator before planting. Drills about 5 inches deep and 32 inches apart were opened out with a single-furrow plough, the sets (both whole and split), being dropped 20 inches apart and covered with harrows. The potatoes were hilled when well in flower. The seed-bed was on the dry side at planting time, resulting in some of the cut sets failing to produce plants. This was especially the case with Teasdale and Redsnooth, which were somewhat exhausted by sprouting before being cut. Of fresh-cut seed, Surprise and Parsons' Seedling missed more than others. Potato moth caused damage. In the fertiliser trial the combination, superphosphate and sulphate of ammonia, applied at the rate of 364 lb. per acre, proved profitable, as did also the mixture P 9.

V. Cornish, Red Range.—Slightly undulating land: free-working, red, basaltic loam: previous crop maize, 1922. Mouldboard ploughed early in September, 7 inches deep, then harrowed twice in the same week, and again twice two days before planting. Drills 5 inches deep were opened about 33 inches apart in a fairly dry seed-bed with a single-furrow mouldboard plough, and three rows of each variety were sown, the centre row consisting as far as possible of whole seed. A proprietary potato fertiliser, costing 13s. 10d. per cwt. was applied alongside the seed in the drill at the rate of 262 lb. to the acre. The potatoes were covered with a cultivator. All varieties were badly affected with potato moth when harvested.

E. Scott, Red Range.—A manurial trial was conducted, an effort being made to sow the different fertiliser mixtures uniformly with a potato-dropping and fertilising machine. The distribution was faulty, however, and the results are not considered comparable and are not published.

Glen Innes.—Practically level ground, typical red basaltic loam; land cropped three years in succession from 1919 with oats (unmanured). The variety trial was planted on 12th October, and the manurial trial on 3rd November by ploughing in the sets in rows 32 inches apart. The low yields and erratic and non-comparable results are attributed to the excessive rains in December causing waterlogging of the soil and rotting of the roots. That potatoes are much more susceptible to damage by excess moisture than maize was evidenced this season on this farm and at Ben Lomond.

Upper North Coast District.

E. S. CLAYTON, Agricultural Instructor.

TRIALS were conducted with potatoes this season in co-operation with the following farmers:—

R. W. Hindmarsh, "Wiaraga," Bellingen.
T. Hannah, junr., "Corra Lynn," Lawrence, Clarence River.
H. Johnson, Condong, Tweed River.
G. Long, "Glengarry," Tetham, Richmond River.
M. McBaron, "Riverview," Raleigh, Bellinger River.
E. L. MacKinnon, "Birchgrove," Maclean, Clarence River.
F. L. Playford, "Merrylands," Nana Glen, Orara River.
Henry Short, "Warrawee," Dorrigo.

Comparable results, however, were only obtained from Lawrence, Condong, Raleigh, Nana Glen, and Dorrigo.

The Season.

The season was not altogether satisfactory for early potato-growing, and while some good yields were obtained, on the Clarence River in particular, many crops were ruined by the excessive rain soon after planting.

Irish blight made its appearance on the Dorrigo plots and caused a reduction in the yield of most of the varieties. The crops were free from insect pests, with the exception of the Bellinger and Orara River plots, on which the larvæ of the 28-spotted ladybird caused slight damage, and the Dorrigo plot, in which grasshoppers made their appearance.

The rainfall for the growing period at the centres where it was recorded was as follows:—

Month.	Condong.	Nana Glen.	Raleigh.	Lawrence.	Dorrigo.
1922.	Points	Points.	Points.	Points.	Points.
August ..	80	20	318	32	.....
September ...	141	925	1,021	565	1,400
October ...	636	272	170	97	205
November ...	260	66	169	69	340
December ...	......	......	......	....	324
1923.					
January ...	......	.....	......	......	840
Total ...	1,117	1,283	1,678	763	3,109

The Plots.

Lawrence.—Soil, alluvial loam; previous crop maize. The plots were planted on 15th August, drills 3 feet apart, 12 inches between the sets and 5 inches deep. The variety trial was manured throughout with superphosphate at the rate of 2½ cwt. per acre. Immediately after planting, the land was rolled and then harrowed. A good deal of second growth occurred on these plots.

Condong.—Soil, fertile alluvial loam; previous crop, maize. The land had been well prepared and was in excellent tilth. The plots were sown on 10th August in drills 3 feet apart, sets 12 inches apart in the row, and 5 inches deep. No manure was applied to the variety trial. Irish blight appeared on the Satisfaction plot, but all the others were quite free from the disease. The yields were very satisfactory. Teasdale produced the largest percentage of unmarketable tubers. Red Ruby yielded well on this plot, being equal to Early Manhattan, Factor, and Up-to-date.

Raleigh.—Soil, fertile alluvial loam; previous crop, Saccaline. Plots planted on 16th August in drills 2 ft. 9 in. apart, sets 14 inches apart. The season proved very favourable, and the growth and subsequent yield were very satisfactory. The crop at all stages looked extremely healthy and vigorous, and caused a good deal of comment in the district.

Nana Glen.—Soil, clay loam, light reddish-brown colour. The land had been well prepared and planting took place on 19th August; rows 2 ft. 9 in. apart, sets 15 inches apart. Superphosphate was applied uniformly to the variety trial at the rate of 2½ cwt. per acre. The heavy rain which fell early in September rotted a large percentage of the sets of Early Rose and caused bad germination in this plot. No other variety was affected in this manner. The plot was harrowed in the early stages to break the surface crust formed by a heavy thunderstorm. The crop was hilled on 9th October.

Early Manhattan had the highest percentage of marketable tubers. This variety was quite free from disease, and the tubers presented a very attractive appearance. Teasdale proved to be a healthy, strong grower, but was much inclined to run to second growth. Red Ruby gave an excellent yield on this plot. The tubers of this variety are of good shape, but the rough skin detracts slightly from their appearance. Factor, although it yielded heavily, had a large proportion of unmarketable tubers. The only variety on which Irish blight appeared was Satisfaction. The larvae of the 28-spotted ladybird caused slight damage throughout the plots.

Dorrigo.—Soil, red volcanic loam, very loose and friable and typical of the better class of Dorrigo land. The experiment was planted on virgin country; rows were 2 ft. 9 in. apart, sets 12 inches apart, and 4 inches deep. The germination and growth throughout the plots were excellent.

Irish blight made its appearance, but was checked by the dry weather at the end of November, but again developed in January, when moist, warm conditions were experienced. Most of the early-maturing varieties matured before the blight made its appearance. As potato crops on the Dorrigo plateau are attacked by this disease almost every season, it may be wise to pay more attention to the growing of such early varieties as Early Manhattan, Early Manistee, Satisfaction, Up-to-date, Arran Chief, and Langworthy in preference to the later varieties, which are less likely to escape attack. Another point for Dorrigo growers to consider is that it is these early varieties that can be so readily sold for seed to growers on the North Coast rivers, particularly on the Clarence River. Grasshoppers were the only insect pest to make an appearance; they caused slight damage to the

crop. On account of the loose, friable nature of the surface soil on this plot the tubers had a tendency, while growing, to work up towards the surface, thus becoming exposed to possible injury by the sun, diseases, and insect pests. To counteract this tendency, hilling should be carefully carried out, and it would also be advisable to plant the sets about 6 inches deep on this loose, friable country.

The Yields.

Many more varieties were under trial at Dorrigo than at any other centre from which comparable results were obtained.

RESULTS of Variety Trials.

Dorrigo—Date sown—19th September.

Variety.	Yield.	Variety.	Yield.	Variety.	Yield.
	t. c. q.		t. c. q.		t. c. q.
Early Manhattan..	4 8 1	Symington	4 0 2	Coronation	5 8 1
Up-to-date	6 0 2	Dakota Red	4 0 3	Arran Chief	5 12 0
Early Rose	4 8 2	Satisfaction (local seed).	5 1 3	Blue Imperial ...	6 0 3
Factor	6 16 3			Cook's Favourite.	5 16 1
Teasdale	5 4 3	Surprise	5 12 2	Bliss Triumph ...	4 8 1
Satisfaction	5 0 0	Tasma	5 16 2	Green Mountain..	5 12 2
Early Manistee ..	5 4 3	Abundance..	4 16 1	Trafalgar Carman	5 8 1
Carman No. 1	6 0 1	Plunkett	5 0 0	Queen of the	
Red Ruby............	4 0 2	Dalhousie...........	6 1 0	Valley	6 0 2
Langworthy...	5 8 2	Scottish Triumph	6 0 3	Adirondack	5 8 2

	Lawrence.	Condong.	Raleigh.	Nana Glen.
Date sown	15th August.	10th August.	10th August.	19th August.
Variety.	Yield.	Yield.	Yield.	Yield.
	t. c. q.	t. c. q.	t. c. q.	t. c. q.
Early Manhattan	3 11 1	5 8 3	8 9 1	4 8 1
Up-to-date	4 1 0	5 4 1	5 10 0	4 17 0
Early Rose	1 17 2	4 12 0	5 9 2	2 16 1
Factor	2 5 0	5 8 3	8 2 3	5 1 0
Teasdale	1 19 0	4 14 1	5 5 3	4 18 1
Satisfaction..	1 17 1	4 2 2	5 1 1	2 17 3
Early Manistee	....	....	6 7 2	....
Carman No. 1.	....	....	6 9 0	....
Red Ruby	1 19 3	5 8 3	7 15 2	5 8 3

The Manurial Trial.

The most suitable fertiliser gave an increase over the plot receiving no manure, of more than a ton per acre at each centre with the exception of Nana Glen, where the increase was only 13 cwt. per acre. From this it will be realised how profitable it is to apply fertiliser to the early potato crop.

RESULTS of the Manurial Trials.

	Lawrence	Condong.	Raleigh.	Nana Glen.	Dorrigo.
Date sown	15th August	10th August.	16th August.	19th August.	19th Sept.
Variety employed.	Early Manhattan.	Up-to-date.	Up-to-date.	Up-to-date.	Langworthy.
	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.
Superphosphate, 2½ cwt.	5 1 1	5 6 1	5 17 3	5 3 0	5 0 0
M7, 3¼ cwt.	4 11 2	5 6 1	5 10 1	5 1 1	5 12 1
Superphosphate, 5 cwt.	4 3 1	4 6 3	5 12 1	5 1 3	5 4 1
P9, 4 cwt.	3 6 3	5 0 0	8 7 1	5 10 3	4 16 1
P7, 2¼ cwt.	3 5 0	5 8 3	8 0 0	5 3 2	5 4 1
No manure	3 5 2	4 3 2	5 10 0	4 17 0	4 8 1
Greatest increase due to fertiliser	1 15 3	1 5 1	2 17 1	0 13 3	1 4 0

* The mixture M7 consists of superphosphate 10 parts and chloride of potash 3 parts. P9 consists of superphosphate 10 parts, chloride of potash 3 parts, and sulphate of ammonia 3 parts. P7 consists of equal parts of superphosphate and bonedust.

There is another consideration of equal, if not of more importance, and that is the physical condition of the land. Numerous instances of potato crop failures on the North Coast last season were traceable to the lack of humus in the soil. Where maize and potatoes are grown continuously without green manuring or the application of farmyard manure, the soil is depleted of humus and cannot be expected to grow successful crops of potatoes. If payable crops are to be looked for from land that has been cultivated for any length of time, a green manure crop, preferably leguminous such as cowpeas or velvet beans, should occasionally be ploughed in to increase the humus content of the soil. Such a proceeding will also have the effect of causing greater benefit to be derived from any artificial fertiliser that may be applied to the potato crop. Where farmyard manure is available, such as is the case on most dairy farms, a liberal application well before planting will obviate the necessity for green manuring. As the area usually sown to potatoes on most North Coast farms is small (generally not more than 2 or 3 acres) sufficient farmyard manure should in most cases be available for the plot intended for potatoes.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Senior Agricultural Instructor.

During the season 1922 the Department carried out potato trials on the following holdings:—

Mr. P. Gersbach, Farm 330, Wamoon.
Mr. J. E. Williams, Farm 56, Leeton.
Mr. J. Hetherington, Farm 338, Leeton.
Mr. P. A. R. Gersbach, Farm 864, Stanbridge.

The Season.

From a potato-grower's point of view the season was very unfavourable and much against the production of heavy yields. A slight frost was experienced in October, and seriously "cut" most of the plots, throwing the plants back, with the result that they matured much later and ran into the hot summer. Shortly following this frost, very hot weather (for that particular time of year), with high, drying winds, was experienced and the growth of the potatoes was again badly affected. It may be claimed that these two setbacks had much to do with the reduced yields obtained.

The rainfall registrations were as follows:—September, 109 points; October, 88; November, nil; December, 251 points.

The December rain was registered in one fall at the end of the month and was of little value to the crop. Evaporation from a water surface for the same period was—September, 2·4 inches; October, 4·9 inches; November, 8·3 inches; December, 8·9 inches: total, 24·5 inches. On perusal of these details it is at once evident that during November, when the potatoes would have greatly benefited by rain, none fell, and at the same time evaporation was high. This state of affairs rendered frequent irrigation necessary.

Harvesting was carried out during the end of December and the beginning of January.

The Plots.

Farm 330.—Red sandy soil; fallowed during the winter. Both variety and manurial trials—the latter with Factor—were conducted on this farm. Planting was done on 21st August, 1922, in rows 3 feet apart and sets 15 inches in the rows. Superphosphate at the rate of 2 cwt. per acre was used in the variety trial. The plot was irrigated on 17th October, 1st November, 16th November, and 29th November, and cultivated on 14th October, 20th October, 3rd and 20th November, and 2nd December.

Farm 56.—A variety trial was carried out on this holding. The soil varied from a grey to red loam, and the potatoes were planted so as to include some of each soil in the various plots. The red soil gave the better yields. The previous crop had been peas, the vines being ploughed under after picking. The land was ploughed in June, disced and harrowed in July, and the sets planted in every fourth furrow 15 inches apart in the rows. Superphosphate at the rate of 2 cwt. per acre was used. Planting was carried out on 22nd August.

The Carman No. 1 seed was very backward, with the result that germination was slow. The crop was cultivated twice in October and again after each watering. The irrigations given were as follows:—October once, November twice, and December once. Manhattan gave the heaviest yield and the highest percentage of marketable potatoes was also obtained from that variety.

Farm 338.—An old piece of lucerne land that had been fallowed since June was used for a variety trial. The soil was a red sandy loam. A dressing of superphosphate at the rate of 2 cwt. per acre was applied in the furrows with the sets. Planting was carried out on 24th August. The plot was watered on 15th November, 27th November, and 7th December, and received cultivations after each watering.

Farm 864.—On what may be considered first-class potato land for the area, plantings of four varieties were carried out on 15th August, 1922. Superphosphate was applied at the rate of 2 cwt. per acre. Peas had been previously grown on the land, which had been fallowed since the previous April. The crop was watered on 1st and 22nd November, and 3rd December, each watering being followed by cultivation.

RESULTS of Variety Trial.

Variety.	Farm 330.				Farm 56.				Farm 338.				Farm 864.			
	t.	cwt	qr.	lb.	t.	cwt.	qr.	lb	t.	cwt.	qr.	lb.	t.	cwt.	qr.	lb.
Up-to-date	3	6	3	12		....			2	10	3	0	4	0	3	9
Teasdale	2	5	0	0		..				.. ...			3	0	1	7
Factor		.. ...			3	3	2	8		... .			2	4	0	17
Red Ruby		......				... ..			2	4	0	0	2	1	1	0
Manhattan		....			4	2	3	12	2	19	2	0		...		
Early Rose	2	8	0	0	3	5	1	12	2	0	2	0		......		
Carman No. 1	2	4	0	4	2	12	2	0		.....				......		

RESULTS of Manurial Trial

Fertiliser per acre.	Farm 330 (Factor).			
	t.	cwt.	qr.	lb.
P9, 4 cwt.	2	12	2	0
Superphosphate, 2 cwt.	2	9	0	0
P7, 2¼ cwt.	2	5	2	0
M7, 3¼ cwt.	2	3	1	0
No manure	1	18	2	0

The compositions of the mixed fertilisers are given on page 625 of this issue

To cover an unsightly old fence both the Dolichos "bean" and Virginian creeper are useful. Ten of the former or five of the latter should be planted for every 20 yards of fence. Seeds and plants of these climbers are obtainable from any nurseryman.—E. N. WARD, Superintendent, Sydney Botanic Gardens.

The Contamination of Milling Wheat.

THE EFFECTS OF STRONG-SCENTED WEED SEEDS.

IN view of complaints from millers and bakers of the effect upon flour and bread of the growth in the wheat crop of the plants known as Hexham Scent and Bokhara clover, a series of experiments was conducted under the direction of a sub-committee of the Experiments Supervision Committee, consisting of Messrs. A. H. E. McDonald, Chief Inspector of Agriculture, G. W. Norris, Milling Investigator, and J. N. Whittet, Agrostologist.

The wheat used in the experiments was first cleaned by washing and drying in order to ensure that it was free from all foreign odours. As a result of certain preliminary tests to ascertain what quantities of the offending seeds might be experimented with, nine milling samples of wheat, each weighing 400 grams, were placed in airtight jars, and to these 1, 3, 5, and 7 per cent. (by count) of the foreign seeds were added. All the samples of wheat were allowed to remain so for seven days, and then, immediately before milling, they were passed over a sieve to remove the small seeds.

The flours obtained from the wheats previously contaminated with 1, 3, and 5 per cent. (by count) of Hexham Scent were baked separately, and the bread examined. Compared with a check loaf made from a city brand of flour, the texture, taste, and appearance of the loaf were satisfactory, but the odour of the bread made from the wheat contaminated with 3 and 5 per cent. (by count) of Hexham Scent certainly suggested the peculiar odour of that weed. In the case of the 1-per-cent. contaminated wheat, it was doubtful whether the characteristic scent could be detected in the bread.

The flour made from wheat contaminated with 3 or 5 per cent. (by count) of Bokhara clover seed, when made into dough, gave the characteristic scent of that plant, but there was a doubt whether it was noticeable in the 1-per-cent. sample. The bread made from these flours was satisfactory in every respect, compared with the check loaf, and there was comparatively no difference in flavour, but in all loaves the scent of the clover was noticeable, being very marked where the higher percentage had been mixed with the wheat. The bread made from 1-per-cent. contaminated wheat was again doubtful.

The experiments clearly demonstrate that wheat contaminated with as small a quantity as 3 per cent. (by count) is detrimental to the baking quality of the flour. In view of the importance of the matter further experiments are being arranged.

FOLLOWING an address by Mr. L. T. MacInnes, Dairy Expert, before a certain recent meeting, a few pleasantries were passed regarding "isations." The Dairy Expert suggested that as well as organisation and stabilisation they needed "improvementisation" and "feedingisation."

Seed Maize Contests.

CENTRAL COAST, 1922–23.

J. M. PITT, Senior Agricultural Instructor.

SEED maize contests played by far the most important part in last season's maize experiments on the Central Coast. In addition to the competitions open to all varieties, conducted on the Macleay and Manning rivers in co-operation with the district agricultural societies—three plots being sown on each river—there was a contest for the Golden Superb variety (one plot) on the Macleay, and a plot for Hickory King on the Manning, the latter being a section of the State-wide contest for that variety: the other plots being situated, one on the Upper North Coast and the other on the South Coast. In that contest, and in that held for the Large Red Hogan variety at Hawkesbury Agricultural College, there were several local entries. It will be seen that the very small beginning these yield contests had when inaugurated on the Manning in 1919 has developed to a very large extent in the Central Coast districts.

The entries for the variety contests were the largest yet recorded—no less than thirty-two on the Macleay and twenty-six on the Manning. These competitions keep before the farmer the comparative yielding abilities of the different varieties, help him in the elimination of poor yielding sorts and the substitution of varieties known to be heavier yielders, or when his strain is yielding poorly in comparison with others higher up the list, the competitions encourage him to make a more rigid selection of seed. Furthermore, the contests are a means of keeping individual districts well to the forefront among the chief agricultural centres of the State.

Outstanding Features.

The outstanding features of the competitions to date have been the splendid performances of Large Red Hogan and Fitzroy. Both of these varieties have been brought to a high yielding standard by careful attention to breeding and selection at Hawkesbury Agricultural College and Grafton Experiment Farm. To win contests in both dry and wet years considerably enhances the value of a variety. The summer months of 1920–21 and 1921–22 were extremely wet, while 1922–23 was one of the driest summers experienced on the Central Coast, especially along the Manning.

The leading performances of these varieties may be presented thus :—

		Manning Contests.		*Macleay Contests.*
Fitzroy—				
1920	...	1st, entered by D. J. Dorward		....
1921	...	5th, entered by J. P. Mooney	...	5th, entered by Brown and O'Shea
1922	...	2nd, entered by H. E. Smart	...	1st and 3rd, entered by J. P. Mooney and F. Waters respectively.
Large Red Hogan—				
1920	...	....		....
1921	...	1st and 3rd, entered by J. P. Mooney and Geo. Levick respectively.		1st, entered by Department of Agriculture (non-competitive).
1922	...	1st and 4th, entered by Geo. Levick and A. R. Longwoith respectively		2nd and 4th, entered by A. R. Longworth and Geo. Levick respectively.

Yellow Hogan—a variety grown mostly on the Macleay (its home)—has been another consistent yielder, being sixth in the Manning contest in 1920, seventh in 1921, and third in 1922, while in the Macleay contests it was second in 1921 and seventh in 1922. All were entered by the well-known grower, Mr. John Booth. Yellow Hogan is a variety largely entered in the Macleay competition. The tables of the yields in the Macleay contest show that it has occupied positions as wide apart as seventh and fifteenth, with twenty-two and thirty-two entries respectively. Such a wide range in position points conclusively to the fact that there is considerable room for improvement in the lower yielding strains. A more careful selection or better strain of the seed seems imperative. Many farmers discard a variety if they suppose it to be yielding poorly, and instead introduce one that has given higher yields. That it is not sound policy, however, when other high-yielding strains of his variety are known to exist. It is far better to secure some of the seed of the better-yielding strain and to mix it with his own. A cross within the variety, coupled with careful selection of the seed, often has the desired effect of raising the yielding capabilities.

THE MACLEAY CONTEST.

This was the second competition to be held in this district. After last season's results were made public, there was a keen demand for seed of the leading varieties, Golden Beauty, Large Red Hogan, and Fitzroy being most sought after. The immediate effect of this importation was noticeable at the last Macleay show, where Golden Beauty was represented by sixteen entries, compared with one or two in previous seasons. There were also substantial increases in the Large Red Hogan and Fitzroy classes. Many of the Golden Beauty cobs measured over 1 foot in length, and were particularly good specimens of the variety.

The Plots.

Three plots were selected for the competition. At Mr. H. J. Wedlock's farm at Frederickton portion of a paddock which had been in cultivation over fifty years was used. In recent years its fertility has been greatly increased by rotating field peas with maize, and during the autumn and

winter prior to sowing the milking cows were depastured on a heavy growth of this legume, and the residues were ploughed under. Germination, except in one or two sections, was good: and although the region was not favoured with perhaps quite as much rain as the other plots, growth was well maintained throughout.

Mr. H. Wheeldon at Gladstone Ridge had the satisfaction of again having the heaviest yields in the competition. The land had been under paspalum pasture for ten to fifteen years; germination was patchy in places.

Mr. T. Keast's plot at Seven Oaks was situated in a well known maize-growing locality. The paddock had been in cultivation about eight years, and as a result of the 1921 flood was covered with a good deposit of silt. Prior to sowing, the land had been in fallow for several months, and a more even plot throughout it would have been difficult to find.

All plots were sown with four grains, hand dropped, 3 feet apart in drills 4 feet apart. They were sown as follows:— Frederickton, 28th September; Gladstone, 29th September; Seven Oaks, 5th October.

The Season.

After the heavy rain in September, summer weather set in immediately, the temperature exceeding 100 deg. Fah. early in October. Most of the hot days were accompanied by dry northerly and westerly winds, and this class of weather lasted throughout the growing period, making the year one of the driest and worst experienced on the Central Coast. Occasionally a storm took place, giving various small falls of rain ranging to 80 points, but these were patchy. It is believed the Gladstone plot fared best, but only about 6 inches of rain were registered at Kempsey over the first four months of growth, and this was greater than where the plots were located.

The rainfall at Kempsey was as follows:—

1922.	Points.	1923.	Points.
October	155	January	235
November	130	February	181
December	203	March	326

Varieties and Types.

Many good samples were sent along for planting, though some lacked uniformity or trueness to variety type- a defect that can be remedied by paying more attention to the selection of the seed. If some farmers sow their own farms with seed similar to that sent in for competition purposes, then they are certainly losing bushels per acre yearly. Big grains, small grains, long grains, short grains, thick grains, thin grains, narrow grains, wide grains, smooth grains, roughly dented grains, floury grains, flinty grains, varying amounts of weevil infestation, grains from the tips and butts,

broken grains—they were all there more or less, and while no sample contained the lot, one or two at least contained a goodly number of the characters.

J. P. Mooney's Fitzroy.—Good sample; good depth and colour; uniform; sound; free from weevil; moderately rough dent.

A. R. Longworth's Large Red Hogan.—Good type; fairly smooth dented; large plump thick grain; uniform; dull colour; good depth; slightly weevily.

F. Waters' Fitzroy.—Good, even, medium rough dented type; good colour; sound; free from weevil; good depth.

TABLE of Yields.

Competitor.	Variety	Yield at Frederickton.		Yield at Gladstone.		Yield at Seven Oaks.		Average yield per acre.	
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
J. P. Mooney, Taree, Manning River.	Fitzroy	87	17	96	40	76	38	86	50
A. R. Longworth, Ghinni ...	Large Red Hogan..	82	21	82	15	94	41	86	26
F. Waters, East Kempsey ...	Fitzroy	86	10	96	44	75	8	86	2
G. Levick, Taree Estate, Manning River.	Large Red Hogan ..	88	39	80	0	84	48	86	29
W. Secomb, Sherwood ...	Macleay Silvermine	72	45	87	24	92	29	84	16
E. H. Ducat, Timagog ...	Narrow Red Hogan	69	55	94	8	88	26	84	11
John Booth. West Kempsey...	Yellow Hogan ...	78	3	99	33	73	45	83	46
W. Secomb, Sherwood ...	Hickory King ...	87	10	79	52	83	4	83	22
W. F. O'Dell, E. Frederickton	Yellow Hogan ...	79	12	93	6	73	41	82	1
N. M. Secomb, Sherwood ...	Hickory King ...	71	44	89	19	84	19	81	46
And. Abbott, Upper Manning (Entered by Dept. Agriculture).	Large Yellow Horsetooth.	77	20	101	3	66	54	81	44
D. Dornan, E. Frederickton ...	Yellow Hogan ...	74	32	93	39	76	21	81	31
S. E. Thurgood, E. Frederickton	Leaming	75	23	82	0	86	20	81	14
John Booth, W. Kempsey ...	Large Red Hogan ..	84	39	68	24	89	28	80	49
H. Wheeldon, Gladstone ...	Hickory King ...	83	4	80	36	77	7	80	16
D. Dorward, Manning River...	Fitzroy ...	79	25	89	11	70	24	79	39
E. H. Ducat, Timagog ...	Yellow Hogan ...	75	45	92	29	70	24	79	33
John Booth, W. Kempsey ...	Hawkesbury Hogan	72	35	103	23	60	51	78	55
Dept. Agriculture	Fitzroy ...	77	49	97	37	60	10	78	32
W. P. Secomb, Sherwood ...	Yellow Hogan ...	71	5	90	7	74	6	78	25
Aden Dornan, E. Frederickton	Yellow Hogan ...	76	50	88	50	68	49	78	12
R. Richardson, Manning River	Golden Beauty ...	75	13	95	42	63	15	78	5
W. J. Seargent, E. Frederickton	Yellow Hogan ...	69	24	88	38	73	41	77	16
Bannerman Bros., Sherwood...	Queen of Prairies...	80	42	78	4	70	53	76	33
J. G. Ward, Sherwood ...	Giant White ...	74	9	83	0	72	31	76	32
H. Wheeldon, Gladstone ...	Golden Beauty ...	80	49	70	36	77	19	76	16
J. Booth, W. Kempsey ...	Macleay Beauty ...	69	27	91	24	67	10	76	2
Ernest Dornan, E. Frederickton	Yellow Hogan ...	75	33	82	11	70	16	76	1
H. Wheeldon, Gladstone ...	Ribbon Hogan ...	70	35	69	42	86	8	75	28
Alb. Jeffrey, Euroka	Hickory King ...	77	32	72	18	75	14	75	3
H. Wheeldon, Gladstone ...	Improved Horsetooth.	62	26	71	25	76	34	70	10
Dept. Agriculture	Leaming	65	0	78	13	61	16	68	10
Average plot yields per acre	...	76	37	86	28	75	40	...	...

Yields.

From the table on page 632 it will be seen that the yields are remarkably even, no less than twenty-seven varieties finishing within 10 bushels of the leader. Large Red Hogan and Fitzroy again filled high positions. Yellow Hogan, perhaps, did not yield quite as well as formerly, and the respective positions occupied by growers of this variety last year were somewhat the same. There were one or two high-yielding strains of Hickory King, one entry filling second place at the Frederickton plot.

The somewhat thin germination of the Red Hogan and Hawkesbury Hogan varieties at Gladstone, no doubt, influenced the yields in these varieties. Golden Beauty and Leaming were not represented by seed quite the equal of last year's competition.

THE MANNING.

This was the third competition conducted in co-operation with the local agricultural society. Interest was well maintained by competitors, and there was no dearth of committeemen and others at the various operations throughout the season. Manning maize growers are among the best pure-seed producers in the State. Quite a number of our heaviest-yielding varieties have been brought to a high state of perfection by the up-to-date methods of the farmers on this river. It is the latest of their successes in this field that three out of the first four positions in the Macleay contest this season were filled by Manning growers, and the remaining position was occupied by a grower who had obtained seed from the Manning district the previous year.

Large Red Hogan and Fitzroy are widely grown on the lower river, the standard being well maintained by the various farmers. Manning Silvermine —the best of the local white varieties— has yielded well, if the present competition be excepted. The dry season somehow did not suit it this year, most of the entries filling the minor places. Later-maturing varieties seemed to have greater drought-resisting powers.

The Plots.

A very rich portion of alluvial soil on the farm of Mr. W. Muscio, Glenthorne, was selected. The paddock had only been in cultivation a few years, excepting as an old lucerne bed. The high average yield from the plot was largely due to the excellent preparation given beforehand, and to the sheltered position—an orchard breaking the force of the severity of the hot winds. Barely 3½ inches of rain fell during the first three months of growth.

At Mr. Ryan's farm at Oxley Island portion of a paddock, the soil of which was of a loamy nature, was selected. The land had been uncropped during the winter. The germination was somewhat patchy and the yields not as comparable as might have been desired. The rainfall was less than at Glenthorne, and a hailstorm in the early stages of growth further thinned the crop.

Portion of a paddock, which had been under pasture and used for a horse and cow run for many years, was selected at Mr. W. McDonald's farm on Taree Estate, the intention being to plant the plot early in October, but the dry weather delayed preparation of the ground, and meantime allowed the seed to become weevily, so that a poor germination resulted and the trial was cancelled.

The Season.

The season was regarded by old hands as the worst ever experienced—dry, hot, windy conditions prevailing throughout the spring, summer, and autumn months. Very little early-sown maize was harvested on the Manning, the majority of the crops being cut out for fodder. The splendid yields at Glenthorne obtained under such unsuitable conditions should stand for many years.

The rainfall at Taree was as follows.—

1922.	Points.	1923.	Points.
October	151	January	311
November	12	February	37
December (11 falls)	181	March	283

Varieties and Types.

Only a few good uniform samples of seed were sent along, the majority having the same defects as those on the Macleay. There is no excuse for sending weevily grain along for sowing. One or two of the white varieties showed yellowish grains. While this may not matter so very much for competition purposes, "white corn" is "white corn," and to supply a customer with crossed seed when pure seed is paid for is only courting trouble.

G. E. Lerick's Large Red Hogan.—Deep grain; very even size, shape, and colour, the latter good; plump; moderately rough dent; weevily.

H. E. Smart's Woodside Dent (Fitzroy Strain).—Very similar to Fitzroy; uneven size; good colour; medium depth; fairly rough dent; weevily.

John Booth's Yellow Hogan.—Very even in size, colour, and shape; deep grain; plump; moderately rough dent; weevily.

A. R. Longworth's Large Red Hogan. Very even in size, shape, and colour; good depth; dull colour; smooth dent; sound; free from weevil.

The Yields.

Large Red Hogan, which is not largely grown, was the outstanding variety of the year, making its second success in three competitions. Manning Silvermine acted disappointingly. It was thought by many that it would yield heavier than the later (longer-season) sorts, but somehow these varieties have greater powers of resistance to dry conditions. This experience was fairly general. The majority of the types of Manning Silvermine entered did not compare favourably with those of former years. Ulmarra Whitecap, Large

Yellow Horsetooth and Hawkesbury Hogan were unfortunate in striking a poor germination at Oxley Island. The yield of 118 bushels to the acre of Ulmarra Whitecap at Glenthorne was exceptionally good.

TABLE of Yields.

Competitor.	Variety.	Yield at Glenthorne. bus.	lb.	Yield at Oxley Island. bus.	lb.	Average yield per acre. bus.	lb.
Geo. Levick, Taree Estate ...	Large Red Hogan ...	109	54	85	45	97	50
H. Smart, Purfleet	Woodside Dent (Fitzroy)	102	42	75	20	89	3
John Booth, Kempsey	Yellow Hogan	95	13	72	12	86	38
A. R. Longworth, Ghinni ...	Large Red Hogan	107	34	64	25	86	2
D. M. Gill, Dumaresq Is.	King of the Earlies .	101	46	67	6	84	26
J. J. Adams, Dumaresq Is. ...	Manning Silvermine ...	90	42	78	12	84	27
Dept. Agriculture	Fitzroy	101	32	66	37	84	6
Dept. Agriculture	Ulmarra Whitecap ...	118	0	49	11	83	34
W. Ryan, Oxley Island	Manning Silvermine ...	91	23	75	20	83	21
J. W. Stitt, Purfleet	Golden Beauty... ..	86	14	75	12	80	41
R. Richardson, Mondrook ...	Manning and Giant White.	89	48	71	21	80	34
Andrew Abbott, Killawarra ...	Large Yellow Horsetooth.	106	16	53	53	80	6
W. J. Adams, Dumaresq Is. ...	Manning Silvermine ...	90	54	69	10	80	4
H. Emerton, Pampoolah	Yellow Hogan	87	36	70	27	79	3
W. Regan, Oxley Island	Fitzroy	87	45	68	32	78	10
J. P. Mooney, Dumaresq Is. ...	Fitzroy	94	9	61	55	78	4
D. Dorward, Dumaresq Is. ...	Fitzroy	96	40	58	39	77	40
R. Richardson, Mondrook ...	Golden Beauty ...	91	38	61	23	76	30
Dept. Agriculture	Pride of Hawkesbury ...	98	14	53	43	76	1
J. J. Adams, Dumaresq Is. ...	Fitzroy	87	42	63	40	75	41
W. Ryan, Oxley Island	Large Red Hogan ...	99	4	50	34	74	47
E. J. Gill, Dumaresq Is.	Manning Silvermine ...	86	12	63	12	74	40
H. Smart, Purfleet	Manning Silvermine ...	87	28	6[illegible]	8	74	18
D. O'Brien, Redhand	Manning Silvermine ...	86	10	61	23	73	45
S. E. Everingham, Moorland ...	Manning Silvermine ...	88	42	54	45	71	43
J. Booth, Kempsey	Hawkesbury Hogan ...	100	14	40	4	70	9
Average plot yields per acre	... ...	95	30	64	21	..	...

THE GOLDEN SUPERB CONTEST.

Golden Superb, a reddish-yellow variety, grown practically only on the Macleay, is noted for its earliness and high-yielding qualities, yields of 100 bushels to the acre and over being common in good seasons. It has been the means of placing the Macleay district in the forefront of early maize-producing districts. Frequently large quantities of this early maize have reached the metropolis during December, and have caught the high prices usually ruling about that time. Of late years, however, the variety has lost some of its purity by becoming crossed with other varieties, and has lengthened its season, with the result that the bulk of the crop has not ripened until

some time later. A considerable amount of this trouble has been brought about by the almost universal use of the power thresher, especially on the large maize-producing areas of the lower river. There the whole crop, without any thought of seed, is husked, threshed, and bagged in the one operation, the older and slower methods—and the best where seed supplies are to be considered—of husking by hand and so on, being mostly confined to the upper river and more distant parts, which localities are now the main source of seed supply. Obviously this limits seed supplying to a few growers, who, on account of the number of other varieties of maize growing in the neighbourhood, find much difficulty in keeping any seed pure.

The Golden Superb Plots at East Frederickton

Later maturing strains are shown by the taller growth on the extreme left and near the figure on the right.

The object of the competition was to discover the grower or growers who have the typical early-maturing, high-yielding strains, so that arrangements can be made to have these more desirable types of seed more extensively grown again in the district. Some ten entries were received, among them being several of the leading growers in the district.

Mr. Donald Dornan, of Pola Creek, East Frederickton, placed a portion of his farm at the disposal of the local agricultural society for the trial, and much of the success of the venture was due to the attention he gave the plot. The soil was an alluvial loam in very good tilth. The previous crop had been maize. The seed was hand-dropped, four grains 2 feet 6 inches apart, in drills 3 feet 9 inches apart on 24th August.

DETAILS of Yields.

Competitor.	Yield.	Approx. maturity compared E. Dornan's entry.	Remarks on type.
	bus. lb.		
C. Kesby, Euroka	105 18	16 to 18 days later.	Very fair type; showing admixture, probably Leaming, hence the lateness.
Alb. Jeffery, Euroka ...	104 33	16 to 18 days later.	Good type; majority Superb, although admixture of Leaming present, showing in early and lateness.
Aden Dornan, East Frederickton.	98 39	3 or 4 days later	Rather poor; very mixed.
E. H. Ducat, Timagog ...	97 54	3 or 4 days later	Best sample in cob and shelled; some extra good cobs.
S. E. Thurgood, East Frederickton.	97 54	Week later ...	Moderately good; mixed with another variety, probably Leaming.
Ern. Dornan, East Frederickton.	94 16	Earliest ...	Fairly good type; some nice cobs present.
John Booth, W. Kempsey...	92 4	Week later ..	Only fairly good; very mixed and uneven.
A. Judd, Euroka	89 7	3 or 4 days later	Fairly good sample; showing variety of strains; mostly Golden Superb.
J. H. Teague, Billimbopinni	86 22	Nearly 2 weeks later.	Medium to good; good colour, although very late.
W. J. Seargent, East Frederickton.	72 51	About 10 days later.	Cobs similar shape to Superb; only pale yellow and very flinty. Cobs small; grain small.

Conclusions.

As was anticipated, the results showed that there were in the ten entries a great variety of types, some maturing over a fortnight later than the earliest. The competition was satisfactory in that it showed competitors how their strains compared with others in the most important characteristics. To those farmers with the later-maturing sorts, and even with the rather poor types, it is suggested that small samples of the more desirable types might be secured and mixed with their own for the seed plot, so as to ensure an infusion of a new strain. Golden Superb is such a good variety of maize that no trouble should be spared to preserve its main features.

THE FRUIT EXPORT TRADE.

THE Department has received from the office of the Agent-General in London for free distribution some copies of the Empire Trade Number of the *Fruit Grower*.

The issue contains information with regard to the landing and handling facilities provided at the principal ports of England in connection with fruit consignments, together with other particulars likely to be of interest to those engaged in the fruit industry in New South Wales. Applications for this publication should be made to the Under Secretary and Director, Department of Agriculture, Sydney. The supply being somewhat limited, letters will be dealt with in the order of their receipt.

Symbiotic Nitrogen Fixation with Non-legumes.

It is now common knowledge that certain plants have knob-like growths on their roots, that these knobs consist of groups of bacteria, and that the nodules are indispensable to the healthy growth of the plants concerned. For long this phenomena was considered to be confined to plants of the leguminous order, but some years ago certain scientists began to point out that symbiotic association of bacteria and plants marked also some plants of other orders, and that in particular certain outgrowths on the leaves, leaf-margins, and seeds of certain plants, were nothing else than groups of bacteria which had the remarkable capacity of fixing the nitrogen of the air and supplying it to the plants. The *Agricultural Journal of India*, March, 1923, contains a paper read by K. Adinarayan Rao, L. Ag., at the Ninth Indian Science Congress, Madras, 1922, in which are related observations of the behaviour of such bacteria on certain plants well known in India. The symbiotic relationship between bacteria and plants is found to be developed to a far greater extent in these cases than in the legumes, and is of a hereditary character. The plants, indeed, are unable to grow in the absence of the bacteria, and it is evident that the assimilation of atmospheric nitrogen in this way is very extensive. Great as has been the influence upon agriculture of the discovery of symbiotic nitrogen fixation in relation to legumes, this author suggests that this later discovery may be of quite as great significance.

Saffron or False Star Thistle.

The menace which the Saffron or False Star thistle (*Carthamus lanatus*) constitutes to the milling industry was made the subject of special representation to the Minister for Agriculture by the Sydney Chamber of Commerce recently, it being suggested that the Department issue a warning to farmers as to the damage the weed is liable to cause to their wheat. It was as long ago as 1894 that the Department issued its first warning under this heading, and in again urging farmers to do everything possible to eliminate the pest from their paddocks it draws attention to the fact that good winter rains will probably make the plant a particular nuisance this spring. The Chief Inspector of Agriculture remarks that the most practical means of keeping this weed in check—as with many other troublesome weeds—is the adoption of up-to-date methods of farming, including the fallowing of the land and the combination of sheep with wheat. Where paddocks are very badly infested it is desirable to delay sowing until after the autumn rains have germinated the thistle seeds, and then to kill off the seedlings with the harrows or spring-tooth cultivator before sowing the wheat.

Wood Ash as a Fertiliser for Fruit Trees.

Although wood ash is a useful commodity on account of its potash content, its use in manuring orchards is not to be recommended as a general practice. If applied to heavy soils, injury to their physical condition will probably result, though on light sandy soils little harm may be done. The amount of potash in wood ash varies considerably, but it may safely be assumed that fourteen parts of ash will contain the same amount of potash as one part sulphate of potash. The best means of utilising wood ash is in the form of compost, or mixed with bonedust or superphosphate.—A. A. Ramsay, Chemist.

Varieties of Maize.

Recommendations by the Department of Agriculture.

The Department has recently revised the list of varieties of maize recommended for various districts, as the result of experiments which have been carried out throughout the State:—

Approximate Order of Maturity of Varieties Recommended.

Very Early.—Early Canada Flint, Sundown, Early Morn, Golden Glow.

Early.—Wellingrove, Gold Coin, Golden Superb, Iowa Silvermine, Funk's Yellow Dent, Goldmine, Craig Mitchell, Coodra Vale.

Midseason.—Hickory King, Boone County White, Leaming, Golden Nugget, Early Clarence, Golden Beauty, Narrow Red Hogan.

Late.—Yellow Hogan, Fitzroy, Large Red Hogan, Yellow Moruya, Ulmarra Whitecap.

Varieties Recommended for Grain.

Upper North Coast.

(a) Tweed River.

Early Crop.—Leaming, Craig Mitchell, Iowa Silvermine.

Main Crop.—Fitzroy, Ulmarra Whitecap, Large Red Hogan (for early sowing only).

(b) Lower Richmond River.

Early Crop.—Hickory King (second-class soils only), Leaming.

Main Crop.—Golden Nugget (second-class soils only), Fitzroy.

(c) Upper Richmond River.

Early Crop.—Leaming, Boone County White.

Main Crop.—Fitzroy, Large Red Hogan, Ulmarra Whitecap.

(d) Clarence River.

Early Crop.—Leaming.

Main Crop.—Fitzroy, Ulmarra Whitecap.

Second-class Soils.—Golden Nugget, Hickory King.

(e) Bellinger River.

Early Crop.—Leaming, Iowa Silvermine.

Main Crop.—Fitzroy, Ulmarra Whitecap.

North Coast Tableland.

Dorrigo and Comboyne Districts.

Main Crop.—Leaming, Golden Superb, Golden Nugget.

MIDDLE NORTH COAST.

(a) Nambucca River.

Early Crop.—Golden Superb, Leaming.
Main Crop.—Fitzroy, Yellow Hogan.

(b) Lower Macleay River.

Early Crop.—Funk's Yellow Dent, Golden Superb, Wellingrove.
Main Crop.—Fitzroy, Large Red Hogan, Yellow Hogan, Golden Beauty.

(c) Upper Macleay River.

Early Crop.—Golden Superb, Funk's Yellow Dent.
Main Crop.—Large Red Hogan, Fitzroy, Yellow Hogan.

(d) Hastings River.

Early Crop.—Funk's Yellow Dent, Craig Mitchell.
Main Crop.—Fitzroy, Large Red Hogan, Golden Beauty, Golden Nugget.

(e) Lower Manning River.

Early Crop.—Funk's Yellow Dent, Craig Mitchell.
Main Crop.—Fitzroy, Large Red Hogan, Yellow Hogan.

(f) Upper Manning River.

Early Crop.—Golden Superb, Funk's Yellow Dent, Iowa Silvermine, Craig Mitchell.

Main Crop.—Fitzroy, Leaming, Golden Beauty, Yellow Hogan.

CENTRAL COAST.

(a) Lower Hunter River.

Early Crop.—Funk's Yellow Dent, Craig Mitchell.
Main Crop.—Large Red Hogan, Fitzroy.

(b) Hawkesbury River.

Early Crop.—Golden Superb.
Main Crop.—Large Red Hogan, Fitzroy.

(c) County Cumberland.

Early Crop.—Hickory King.
Main Crop.—Fitzroy.

SOUTH COAST.

(a) Illawarra District.

Early Crop.—Funk's Yellow Dent, Goldmine, Iowa Silvermine, Craig Mitchell.

Main Crop.—Large Red Hogan, Fitzroy, Yellow Hogan.

(b) Shoalhaven River.

Early Crop.—Funk's Yellow Dent, Boone County White.

Main Crop.—Leaming, Funk's Yellow Dent, Fitzroy, Boone County White.

SOUTH COAST—*continued.*

(c) Milton District.

Early Crop.—Funk's Yellow Dent, Boone County White, Goldmine, Iowa Silvermine.

Main Crop.—Fitzroy, Large Red Hogan, Leaming.

(d) Moruya River.

Early Crop.—Funk's Yellow Dent, Boone County White.

Main Crop.—Large Red Hogan, Yellow Moruya.

(e) Bega River.

Early Crop.—Funk's Yellow Dent, Boone County White, Goldmine, Iowa Silvermine.

Main Crop.—Large Red Hogan, Yellow Moruya, Golden Beauty.

NORTHERN TABLELAND.

(a) Tenterfield District.

Wellingrove, Funk's Yellow Dent, Golden Glow.

(b) Glen Innes District.

Wellingrove, Golden Glow.

(c) Ben Lomond, Llangothlin, Guyra, and Black Mountain Districts.

Early Morn, Golden Glow, Sundown.

(d) Armidale District.

Funk's Yellow Dent, Wellingrove, Golden Glow, Gold Coin, Golden Superb.

(e) Uralla District.

Wellingrove.

CENTRAL TABLELAND.

(a) Bathurst District.

Alluvial Soils.—Funk's Yellow Dent, Iowa Silvermine.

Upland Soils.—Iowa Silvermine.

(b) Colder Districts.

Early Morn, Sundown, Early Canada Flint.

SOUTHERN TABLELAND.

Moss Vale District.

Golden Glow.

NORTH-WESTERN SLOPES.

(a) Inverell District.

Funk's Yellow Dent, Iowa Silvermine, Wellingrove.

(b) Tamworth and Upper Hunter Districts.

Alluvial Soils.—Funk's Yellow Dent, Iowa Silvermine.

CENTRAL-WESTERN SLOPES.

Alluvial Soils.—Funk's Yellow Dent, Iowa Silvermine.

Upland Soils.—Funk's Yellow Dent, Iowa Silvermine, Early Morn.

SOUTH-WESTERN SLOPES.

(*a*) *Tumut River.*

Rich Alluvial Flats.—Early Clarence, Funk's Yellow Dent, Leaming, Craig Mitchell.

Second-class Alluvials.—Funk's Yellow Dent, Iowa Silvermine.

(*b*) *Murrumbidgee River* (*Gundagai District*).

Funk's Yellow Dent, Leaming, Coodra Vale, Iowa Silvermine.

MURRUMBIDGEE IRRIGATION AREAS.

Funk's Yellow Dent, Iowa Silvermine.

Varieties Recommended for Green Fodder.

COASTAL DISTRICTS.

Early Varieties.—Hickory King, Leaming, Boone County White.

Late Variety.—Fitzroy.

TABLELAND DISTRICTS.

For Warmer Districts.—Fitzroy.

For Cooler Districts.—Hickory King, Leaming.

For Coldest Districts.—Wellingrove.

WESTERN SLOPES AND MURRUMBIDGEE IRRIGATION AREAS.

Fitzroy.

"THE FIRST BOOK OF GRASSES."

THIS valuable little book—another of the Rural Text-book Series—aims at giving those with little or no knowledge of botany, such an understanding of the structure of grasses as will enable them to use manuals of botany and other technical works with greater facility. The idea of a primer has been kept well in mind by the author, Agnes Chase, Assistant Agrostologist of the United States Department of Agriculture. The principal grasses have been presented quite simply according to their related forms, and the reader is encouraged at the outset to regard the use of specific terms with equanimity. The 120 pages have some ninety-four drawings and diagrams, which lead the student on from the simplest forms to the more complex ones, until he is able to identify probably all the common species of grasses of the northern hemisphere, and he will perhaps conclude with the author at the finish that "when the structure of grasses is clearly understood, they are not more difficult to study than are other plants."

The book is of special use to the student, and to him can be commended as really excellent.

Our copy from the publishers, the Macmillan Company, New York.

Notes on Wheats entered for the Royal Agricultural Society's Show.

EASTER, 1923.

G. W. NORRIS, Milling Investigator.

THE wheat exhibit was arranged in the Royal Agricultural Hall in the Farrer Court, being displayed in rows of glass cases, which may not be very popular with the majority of the visitors, but which afford the public an opportunity of seeing for themselves striking evidence of the great agrarian wealth of the State. To the exhibits that had been milled a card was attached showing the results obtained by milling the wheats and of the testing of the flour obtained, so that each competitor or anyone interested in the subject could see the reasons which influenced the judge in his decision.

This is the first occasion on which the judging has been done by one judge, and the writer, who carried out the work, felt the loss of his fellow judge, Mr. R. W. Harris, with whom he had been associated in this capacity for the past fifteen years.

As in past years, the judging was based principally on the behaviour of the samples in the model mill of the Department of Agriculture.

For the benefit of those interested it might be as well to explain briefly the general procedure adopted in judging an exhibit of this kind. As soon as the exhibits are received by the Royal Agricultural Society a sample is taken out, placed in a clean calico bag, branded with a number as well as the class, and forwarded to the Chemical Laboratory, Department of Agriculture. When a complete class has arrived the bags are opened, and after a careful inspection to eliminate inferior exhibits, those which are considered eligible for prizes are milled and points awarded as in the milling table. At this inspection exhibits in their wrong class are re-classified and judged in their correct class. This inspection has to be very severe in order to arrive finally at a decision, and the slightest foreign smell of any description, such as weevil, mice, smut, &c., damaged germs, or stray seeds spoils the chance of the exhibit getting a prize. It may appear to the exhibitor that the preliminary inspection is far too severe, but when examining a collection of fifteen samples, such as with the Canberra Special Class, all of which are worthy of a prize to the casual eye, one is compelled to magnify faults, particularly when there is only one prize.

Some Remarks.

The general standard was fully maintained in the wheats exhibited this year. There were a few exceptions, as might be expected with a large collection of wheats grown over such an extended area. The macaroni wheats dropped out altogether, and the Strong Red Class was disappointing in quality as well as in numbers, there being only three entries. In the red wheats, the variety Cedar exhibited by Messrs. D. and J. Gagie, of West Wyalong, easily secured first place with 87 points, its strong point being quality of flour, although in this respect it was not so good as in previous years. The second prize went to a sample of Marquis exhibited by Mr. R. Smith, of Eulah Creek, which had a very small margin of half a point from a sample of the same variety.

The Strong White Class had about the same number of entries as last year, but the range of varieties was greater. The first prize went to Mr. A. R. Michael, of Woomelang (Vic.), with a sample of Comeback, which secured 95 points. This sample still maintained the high flour standard for which this variety is noted. It yielded 72 per cent. of flour, containing 15 per cent. of dry gluten and a very high water absorption of 57 quarts per 200 lb. of flour. The second prize was awarded to Mr. W. H. Scholz, of Gilgandra, for a very fine sample of Quality. This is the first occasion that this variety has competed against Comeback. It secured a very creditable position, gaining 92½ points. The outstanding features were exceptionally heavy weight, being nearly 68 lb. per bushel, and the high flour yield of 74.3 per cent., the flour containing 12.3 per cent. of dry gluten, while the water absorption was very high—54 quarts per 200 lb. sack of flour.

The Medium Strong Flour Class was well represented, there being nineteen entries, the first prize going to Mr. J. W. Eade, of Euchareena, for a very attractive sample of Canberra, which weighed 67 lb. per bushel and gained 81½ points. The second prize, also a sample of Canberra, exhibited by Mrs. J. Berney, of Eurimbla, secured 79½ points.

The special prize for the variety Florence attracted a good entry, but was easily secured by Mr. W. H. Scholz, of Gilgandra. It was a splendid sample of exceptional weight, being 68½ lb. per bushel, which is a record for this variety. In addition to being heavy, it produced a high yield of flour, containing 12 per cent. of dry gluten and a flour strength of 47 quarts per 200 lb. of flour. Both the Farrer and Non-Farrer classes were poorly represented, there being only two entries in each. The collection exhibited by Mrs. J. Berney was easily the best, even when compared with the collection of five non-Farrer wheats. In concluding, I wish to thank Mr. W. M. Dill Macky, of the Department of Agriculture, for his assistance.

WEIGHTS PER BUSHEL.

Catalogue No.	Variety.	Bushel Weight.	Catalogue No	Variety.	Bushel Weight.	Catalogue No	Variety	Bushel Weight.
				Class 1106 (Strong Flour, Red).				
6774	Cedar ...	... 66	6775	Marquis...	... 65¼	6776	Marquis	... 63½
				Class 1107 (Strong White).				
6677	Comeback	... 66¼	6679	Minister...	... 64¼	6681	Comeback	... 65¾
6678	„	... 66	6680	Pusa No. 4	... 67¾	6700	Quality ...	... 67¾
				Class 1108 (Medium Strong).				
6682	Canberra	... 66¾	6689	Gresley ...	... 65	6695	Yandilla King	... 66
6683	„	... 66	6690	Canberra	... 65	6696	Canberra	... 63¾
6684	Cleveland	... 64¾	6691	Improved Steinwedel ...	... 65¼	6697	Bomen ...	... 66
6685	Bald Early	... 64¾	6692	Marshall's No. 3	63	6698	Marshall's No. 3	64½
6686	Canberra	... 67	6693	Canberra	...64¾	6699	Canberra	... 65¼
6687	„	... 65¾	6694	Firbank...	... 64	6701	Bunyip ...	... 65½
6688	„	... 63¾						

Weights per Bushel—*continued.*

Class 1109 (Special Prize—Florence).

6702	Florence	... 63½	6705	Florence	.. 66¼	6708	Florence	... 68¼
6703	,,	... 64¾	6706	,,	... 63¼	6709	,,	... 65
6704	,,	... 67¾	6707	,,	... 65½	6710	,,	... 63¼

Class 1110 (Special Prize—Canberra).

6711	Canberra	... 66¾	6716	Canberra	... 68¼	6721	Canberra	... 64½
6712	,,	... 66¼	6717	,,	... 66	6722	,,	... 64¾
6713	,,	... 67	6718	,,	... 65	6723	,,	... 65¼
6714	,,	... 64½	6719	,,	... 65¾	6724	,,	... 66
6715	,,	... 63¾	6720	,,	... 65	6725	,,	... 64½

Class 1111 (Special Federation [Novice]).

6726	Federation	... 64¼	6729	Federation	... 63¾	6732	Federation	...
6727	,,	... 63¾	6730	,,	... 63	6733	,,	... 63¼
6728	,,	... 65	6731	,,	... 64¼			

Class 1112 (Special Federation).

6734	Federation	... 63¾	6736	Federation	... 64¼	6738	Federation	... 64¼
6735	,,	... 64¾	6737	,,	... 63¼			

Class 1113 (Special Prize—Hard Federation).

6739	Hard Federation	65½	6741	Hard Federation	64½	6743	Hard Federation	65¾
6740	,, ,,	66¼	6742	,, ,,	... 67¾	6744	,, ,,	63¼

Class 1114 (Weak Flour).

6745	Currawa	... 63¼	6749	Federation	... 64¼	6752	Federation	... 63¾
6746	Penny ...	... 62	6750	College Purple Straw...	... 64¾	6753	Currawa	... 65½
6747	Currawa	... 67¼	6751	Warden	... 64	6755	Penny ...	... 64½
6748	,,	... 63½						

AWARDS.

Class 1106— Strong Flour Red.	First Prize, No. 6674—D. and J. Gagie; Cedar; grown at West Wyalong, New South Wales, on clay soil; seed per acre, 60 lb.; yield per acre, 10 bushels; rainfall during growth, 6·36 inches; fallow. Second Prize, No. 6675—R. Smith; Marquis; grown at Eulah Creek, New South Wales, on sandy loam; seed per acre, 60 lb.; yield per acre, 15 bushels; rainfall during growth, 7·5 inches; autumn ploughing.
Class 1107. Strong White.	First Prize, No. 6678—A. R. Michael; Comeback; grown at Woomelang, Victoria, on sandy loam; seed per acre, 43 lb.; yield per acre, 16 bushels; rainfall during growth, 5·7 inches; winter fallow. Second Prize, No. 6680—W. H. Scholz; Quality; grown at Gilgandra, New South Wales, on sandy loam; seed per acre, 45 lb.; yield per acre, 24 bushels; rainfall during growth, 4·43 inches; fallow.

Awards—*continued.*

Class 1108— Medium Strong.	First Prize, No. 6686—J. W. Eade; Canberra; grown at Euchareena, New South Wales, on chocolate loam; seed per acre, 45 lb.; yield per acre, 18 bushels; no record of rainfall: fallow. Second Prize, No. 6682—Mrs. J. Berney; Canberra; grown at Eurimbla, New South Wales, on light loam; seed per acre, 50 lb.; yield per acre. 22 bushels; rainfall during growth, 6·50 inches; autumn ploughing.
Class 1109— Florence Special.	Special Prize, No. 6708—W. H. Scholz; Gilgandra, New South Wales, on sandy loam; seed per acre, 45 lb.; yield per acre, 16 bushels; rainfall during growth, 4·43 inches; fallow.
Class 1110— Canberra Special.	First Prize, No. 6713—J. W. Eade; Euchareena, New South Wales, on chocolate loam; seed per acre, 45 lb.; yield per acre, 18 bushels; no record of rainfall during growth; fallow.
Class 1111— (Novice) Federation Special.	First Prize, No. 6731—A. E. Michael; Woomelang, Victoria, on heavy loam; seed per acre, 36 lb.; yield per acre, 24 bushels; rainfall during growth, 7 inches; fallow.
Class 1112— Federation Special.	First Prize, No. 6736—A. R. Mudge; Berrigan; N.S.W., on red loam; seed per acre, 37 lb.: yield per acre, 27 bushels; rainfall during growth, 8·71 inches; fallow.
Class 1113— Hard Federation Special.	Special Prize, No. 6743—A. R. Michael, Woomelang, Victoria; on heavy loam; seed per acre, 37 lb.; yield per acre, 15 bushels; rainfall during growth, 7·46 inches; summer fallow.
Class 1114— Weak Flour.	First Prize, No. 6750—McClentock Bros.; College Purple Straw, grown at Rocklands, New South Wales, on red loam, clay subsoil; seed per acre, 45 lb.; yield per acre, 12 bushels; rainfall during growth, 4·8 inches; spring fallow. Second Prize, No. 6747—J. W. Eade; Currawa, grown at Euchareena, New South Wales, on chocolate loam; seed per acre, 45 lb.; yield per acre, 15 bushels; no record of rainfall; fallow.
Class 1115— Collection of Five Farrer Wheats.	First Prize, No. 6756—Mrs. J. Berney, Eurimbla, New South Wales; Bomen, Canberra and Rymer, on light soil; Clarendon and Hard Federation, on red loam; seed per acre, Bomen and Canberra, 50 lb.; Clarendon, 60 lb; Hard Federation, 56 lb.; Rymer, 55 lb.; yields per acre, Bomen, 18 bushels; Canberra, 22 bushels; Clarendon, 15 bushels; Hard Federation, 16 bushels; Rymer, 30 bushels; rainfall during growth, Bomen, 7 inches; Canberra, 6·5 inches; Clarendon and Hard Federation, 5·8 inches: Rymer, 7·25 inches; Bomen and Rymer, summer fallow; Canberra, autumn ploughing: Clarendon and Hard Federation; fallow. Second Prize, No. 6757—R. Smith, Eulah Creek, New South Wales; Bunyip, Canberra, Comeback, Florence, Hard Federation; grown on sandy loam; seed per acre, 60 lb.; yield per acre, 15 bushels; rainfall during growth, 7·5 inches; autumn ploughing.

RESULTS OF MILLING TESTS.

	Appearance of Grain.	Weight per bushel.		Ease of Milling.	Percentage of Flour.		Colour	Percentage of Gluten.		Strength.		Total Points.
	—	Points Awarded.	Actual Weight.	—	Points Awarded.	Actual per cent.	—	Points Awarded.	Actual per cent.	Points Awarded.	Water Absorption.	—
Maximum Points.	10	15		10	10		15	20		20		100
Class 1106 (Strong Flour, Red).												
6674	10	13	66	9	9	72·9	14	17	13·49	15	51	87
6675	9	12	65¼	9	8	70·3	15	16	12·77	11	47	80
6676	8	10½	63½	9	8	70·1	15	18	14·45	11	47·4	79½
Class 1107 (Strong Flour, White).												
6677	10	13½	66½	10	10	74·7	13	19	14·96	15	50·8	90½
6678	10	13	66	10	9	71·9	14	19	15·0	20	57·0	95
6679	9	11	64¼	10	8½	71·3	15	16	12·0	13	49·0	82½
6680	10	14½	67¾	10	9	72·5	13	15	11·0	17	53·2	88½
6700	10	14½	67¾	10	10	74·3	14	16	12·3	18	54·0	92½
Class 1108 (Medium Strong Flour).												
6682	9	13½	66¾	10	9	72	15	12	8·7	11	47·0	79½
6683	9	13	66	10	8½	71·5	14	13	9·8	11	46·6	78½
6686	10	14	67	10	8½	71·4	13	15	11·1	11	47·0	81½
6691	8	12	65¼	10	8½	71·6	14	16	11·9	10	46·0	78½
Class 1109 (Florence Special).												
6705	10	13	66¼	10	9	72·2	15	17	13·86	11	46·8	85
6708	10	15	68¼	10	10	74·9	14	16	11·94	13	49·0	88
Class 1110 (Canberra Special).												
6713	10	14	67	10	8	71·4	12	15	11·1	11	47	80
6717	10	13	66	10	9	72·5	13	14	9·9	9	45·4	78
6724	10	13	66	10	9	71·8	11	15	11·0	10	46·4	78
Class 1111 (Novice Federation Special).												
6731	10	10	63	10	9	72·1	15	16	12·6	10	46	80
6732	10	11	64¼	10	10	73·4	13	15	11·8	9	45·4	78
Class 1112 (Federation Special).												
6735	9	11½	64¾	10	9	71·9	14	16	12·3	9	45	78½
6736	10	11	64¼	10	9	71·8	15	17	13·1	9	45	81
Class 1113 (Hard Federation Special).												
6741	10	11½	64½	10	10	75	15	16	12·3	15	50·8	87½
6743	10	12½	65¾	10	9	72·6	15	19	15·3	14	49·6	89½
Class 1114 (Weak Flour Class.)												
6747	10	14	67½	10	9	72·6	12	13	9·4	10	46·0	78
6749	10	11	64¼	10	9	71·6	15	13	9·6	8	44·4	76
6756	10	11½	64¾	10	10	72·9	14	17	13·3	8	44·0	80½

RESULTS OF EXAMINATION OF THE WHEATS IN CLASSES WHICH WERE NOT SUBJECTED TO MILLING TEST.

Catalogue No.	Variety.	Weight per bushel. Points Awarded.	Weight per bushel. Actual Weight.	Appearance of Grain.	Trueness to Type.	Uniformity.	Total.
	—			—	—	—	—
	Maximum Points.	15		10	10	10	45
	Class 1115 (Collection of Five Farrer Wheats).		lb.				
6756	Bomen	13	66¼	8	9	8	38
	Canberra	13½	66¾	9	9	10	41½
	Clarendon	12	65¼	9	9	9	39
	Hard Federation ...	12	65¼	9	10	10	41
	Rymer	13½	66½	8	9	9	39½
							199
6757	Bunyip	12½	65½	9	9	9	39½
	Canberra	13	66	9	9	9	40
	Comeback	12	65¼	8	9	8	37
	Florence	11½	64¾	9	9	9	38½
	Hard Federation ...	12	65	8	8	8	36
							191
	Class 1116 (Collection of Five Non-Farrer Wheats).						
6758	Billy Hughes ...	12	65	10	10	10	42
	Currawa	13½	66¾	7	10	8	38½
	Gresley	13	66	9	10	9	41
	Improved Steinwedel	12	65¼	8	8	8	36
	Purple Straw ...	11½	64½	7	8	8	34½
							192
	Austrian	11½	64¾	8	10	8	37½
	Bald Early	11½	64¾	9	10	10	40½
	Currawa	12	65	8	10	8	38
	Minister	11½	64½	9	9	9	38½
	Yandilla King ...	12½	65¾	9	9	9	39½
							194

De-horning Ram Lambs.

The wisdom of de-horning male lambs which had been castrated at a later stage than is usual was raised by a recent correspondent.

It is doubtful whether any good purpose would be served, was the reply Ram lambs of the horned breeds develop horns very rapidly, and even if left until between the six and twelve-months-old period (during which ram lambs are ready for the first culling) the horn cores are so well developed that the saw would be the only possible method of removal. This would certainly remove the entire horn, but it would leave a large scar, which would be easily noticeable to any casual inspection. The operation would be a very cruel one, however, and on that account is seldom attempted.—F. B. Hinton, Sheep and Wool Expert.

Varieties of Wheat Recently Grown at Cowra.

J. T. PRIDHAM, Plant Breeder.

The following list is intended to be supplementary to the list of varieties published in the *Agricultural Gazette* in January, 1921. The information given is meagre, but full descriptions would take up too much space, and any varieties that prove themselves specially valuable to the farmer will be more fully described at some future time. The object is to give in a few words an idea whether a wheat is worth consideration or not, so that farmers may glean a few facts about the varieties which scientific workers are using in their experiments, or which are advertised or quoted in the press. Where a pedigree is given in the column showing the origin of a wheat it is a Departmental crossbred.

It should be remarked that wild synthetic wheat was not produced here by crossing, but, I believe, in America. The Pusa wheats were bred by the Imperial Economic Botanist at Pusa, Bihar, India.

No specific districts have been recommended for the different varieties, but as a general rule those received from Victoria, South Australia, and Western Australia are more or less adapted for the chief wheat-growing lands of this State.

Varieties received from Europe and America, even if not definitely stated to be unsuitable, should be received with caution, and only tried in small plots. The Department cannot undertake to supply any seed of the varieties.

Key to Table.

Season.	E	Early, to be sown late.
	M	Midseason, to be sown midseason.
	L	Late, to be sown early.
Use.	H	Adapted for hay.
	G	Adapted for grain.
	HG	General purpose.
	F	Fodder; silage or green fodder.
Class.	S	Soft or weak flour grain.
	M	Medium soft flour grain.
	H	Hard or strong flour grain.
	P	Grain only suitable for pigs and poultry.
	D	Durum or macaroni grain.

VARIETIES of Wheat recently grown at Cowra.

Variety.	Season.	Use.	Class.	Origin.	Defects.	Distinguishing characters and good points.
Abyssinian	M	F	P	Abyssinia	Awned	Purple-tinted grain.
Acme	L	F	D	United States of America	"	Rust resistant.
Akeo	L	...	...	Japan	Rather too late	Clubbed ear.
Alaska	L	F	P	Mediterranean	Awned	Branched or composite ear.
American Club	L	HG	S	America	"	Brown ears.
Arnautka	M	F	D	Russia	"	Ear more slender than Kubanka.
Aurora	E–M	HG	S	France	Tends to shatter	Brownish ear.
Aussie	E	HG	S	Federation x Gluyas	....	Rather like Federation; straw not so strong.
A 88	E	G	S	South Africa	Rust liable	Brown clubbed ear.
Bald Knob	E	G	S	Redskin x Yandilla	Straw rather brittle	White, awnless, slightly clubbed ear.
Biffen's Red Fife	L	F	H	England	Shatters somewhat	Used in crossing.
Biffen's White Fife	L	F	H	"	"	"
Blue Wave	E	G	S	South Australia	Rust liable	Much like Federation.
Bobs x Federation	E	G	S	Victoria	....	Brown ears.
Bonus	M	HG	S	South Australia	Shatters slightly	Tapering white awnless ear; reddish grain.
Booran	E	HG	S	Western Australia	....	Very fair hay; tall.
Burbank	L	F	S	United States of America	Too late for New South Wales.	= Jones' Fife; downy glume.
Cad	M	HG	M	South Australia	Somewhat coarse for hay	Rather short straw.
Cadet	M	HG	S	"	" "	Light red grain.
Canaan	E	HG	S	"	" "	Holds grain well.
Carrabin	E	HG	M	Western Australia	Straw medium strong	....
Club	E	G	S	America	....	Holds grain; dense ear.
Covelle	L	F	D	Western Australia	....	Awnless.
Caballing	E	HG	S	"	Shatters slightly.	....
Daruma	M	G	...	Japan	Awned	Straw very short.
Dindiloa	E	HG	M	Western Australia	Medium strong straw	Holds grain rather tightly.
Dollar	M	HG	S	Victoria	Straw rather brittle	Large, somewhat clubbed ear.
Early Bird	E	HG	S	Federation x Volga barley	Straw rather weak	Very early maturing.
Early Crossbred 53	L	H	S	Western Australia	Heavy flag	= Zealand Blue.

VARIETIES of Wheat recently grown at Cowra—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Defects.	Distinguishing characters and good points.
Early Lambrigg	M	HG	M	Sport from Blount's Lambrigg	Tends to shatter	Small, white grain.
Early Red Chief	L	F	S	United States of America	Red grain	Dense, brown ear.
Eden	E	HG	H	Fife-Indian crossbred...	Moderate yielder	....
Einkorn	L	F	P	Europe	Very hard to thresh	Very slender, white ear.
Emmer (Black)	L	F	P	,,	,, ,,	Awnless, white ear.
Emmer (White)	L	F	P	,,	,, ,,	Awned black ear.
Emperor	E	HG	S	South Australia	Straw medium strong	Semi-solid straw.
Ensign	M	HG	S	,,	....	Has purple straw.
Etawah	E	G	M	Fife-Indian crossbred...	Straw quite short	....
Exquisite	E-M	HG	S	South Australia	....	Semi-solid straw; holds its grain.
Fano	E	HG	S	,,	....	Strong straw.
Felix	E	HG	S	,,	....	Purple semi-solid straw.
Fenman	L	F	S	England	Too late for New South Wales.	Strong straw; dense ear.
Flamen	E	HG	S	South Australia	....	Tall, coarse straw.
Ford	E	HG	S	,,	....	Seems productive.
Forelock	M	G	S	Federation x Volga barley	Awned	Better straw than others of this pedigree
Forge	M	HG	S	South Australia	....	Glumes rather pubescent.
Fortune	E	HG	S	,,	....	Rather like Marshall's No. 3.
Fukoku	L	HG	...	Japan	....	Awnless, clubbed ear.
Galgalos	L	HG	S	Russia	Weak straw, shatters	Red ear.
Gallipoli	M	G	S	Victoria	....	Brown ear, short straw.
Geeralying	E	HG	M	Western Australia	Tends to shatter	....
Ghirka	L	F	M	Russia	Red grain	Resembles Fife.
Ghurka	E	G	H	Yandilla King x Zaff	Straw slightly weak	Brown, tip awned ear.
Glencope	E	HG	S	South Australia	....	General purpose sort.
Graham	M	HG	S	Victoria...	....	Rather like Yandilla King.
Hamel	E	HG	S	Western Australia	Slender, weak straw	....
Harvester	L	F	S	England	Too late for New South Wales	Dense ear.
Heywood's	E	HG	S	New South Wales farmer's selection.	....	Somewhat like Florence.
Hoof's Imperial	E	G	S	,, ,,	....	A selection from Federation.

VARIETIES of Wheat recently grown at Cowra—*continued*

Variety.	Season.	Use.	Class.	Origin.	Defects.	Distinguishing characters and good points.
Hornbill	E	F	M	Florence x Huguenot ...	Hard to thresh	Rust resistant.
Hornblende	L	F	H	United States of America ...	Shatters, and too late ...	Used in crossing.
Indian F. x Federation	E	HG	S	Victoria...	....	Seems productive.
Indian E x Telford's	E	HG	S	„	....	Dense, rather clubbed ear.
Indian H x Telford's	M	HG	S	„	....	„ „
Japanese No. 6 ...	M	HG	S	Japan	Shatters, awned	Nodding ear, slender straw.
John Bull	L	F	S	England	Too late for New South Wales	Dense ear.
Jubilee	E-M	HG	S	Victoria...	....	Good hay wheat.
Kahla	L	F	D	Algeria	Awned	Black ear and awns.
Keswycke	E	HG	S	New South Wales farmer's selection.	Tends to shatter	Nodding, lax ears.
Khapli	E	F	P	India	Very hard to thresh ...	One of Emmer class.
Kota	L	HG	H	Russia	Awned; red grain	Rust resistant.
Little Club	M	G	S	South America...	Rust liable	Holds grain; short ear.
Lott's White ...	E	HG	S	South Australia	....	Good hay wheat.
Mac's White	E	HG	S	Victoria...	Tends to shatter	....
Maharajah ...	E	HG	S	South Australia	Straw slightly brittle ...	Semi-solid straw.
Marouani	M-L	F	D	Algeria	Awned	Rust and drought resistant.
Merredin	E	HG	S	Western Australia	Straw, medium strong ...	General purpose.
Mindum	M-L	F	D	United States of America ...	Awned	Rust resistant, like Arnautl c.
Nabawa	E	HG	S	Western Australia	....	Ears rather dense.
Nandero	E	G	M	India	Straw too short for hay ...	....
Nangeenan	E	HG	S	Western Australia	....	Rather coarse straw.
Narrogin	E	HG	S	„	....	Brown awnless ear.
Narrogin 7	M	HG	S	„	....	Tapering, white awnless ear.
Narrogin 8	E	HG	S	„	....	Ears resemble Federation.
Narrogin 9	M	HG	M	„	Straw medium strong ...	White, awnless ears.
Nevertire	L	F	D	Blount's Lambrigg x Polish ...	Sparse stooler	Awnless.
Niloc	E	G	M	Western Australia	Straw somewhat brittle ...	Awnless; grain somewhat rounded.
Nullah	E	G	M	New South Wales Department crossbred.	Medium hardy	Dense, awnless, white ear.
Nungarin	E	HG	S	Western Australia	....	Brown, awnless ear.

VARIETIES of Wheat recently grown at Cowra—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Defects.	Distinguishing characters and good points.
Ojima	M	HG	...	Japan	Awned	Clubbed ear.
Onas	M	HG	S	South Australia	....	Seems productive.
Peace Hybrid ...	L	F	S	France	Too late for New South Wales	....
Pedigree Snowdrop White.	L	F	S	England	„ „ ...	....
Pelissier	L	F	D	Algeria	Awned	White ear, black awns.
Persian Black ...	L	H	S	Persia	....	Very erect habit.
Plowman's 2 ...	E	HG	S	New South Wales farmer's selection.	Light, red grain	Brownish ears.
Plowman's 3 ...	E	HG	S	„ „ ...	....	White grain; dark brown ear.
President	E	HG	S	South Australia	Straw rather weak	Semi-solid straw.
Prizetaker	L	HG	S	United States of America ...	Too late for New South Wales	Purple straw; rather clubbed ear.
Pusa 4	E	G	H	India	Straw rather weak	Holds grain.
Pusa 6	E	G	M	„	Straw fair quality	„
Pusa 12	E	G	M	„	Straw rather weak	„
Pusa 31	E	G	H	„	„	„
Pusa 45	E	G	H	„	„	Ear rather like Bobs.
Pusa 107	E	G	H	„	„	Ear medium pubescent.
Pusa 110	E	G	M	„	„	Awned.
Quality	L	HG	M	United States of America ...	Liable to shatter	Resembles White Lammas.
Quantity	E	HG	S	„ „ ...	„	....
Rajah	E	HG	S	South Australia	....	Semi-solid straw.
Redilla	L	HG	S	Victoria	Rather too late	Dense, awnless, white ear.
Redskin	L	HG	S	New South Wales Department crossbred.	Grain light red	....
Rerraf	E	G	M	Sport from Blount's Lambrigg	Straw not very strong ...	Rust escaping.
Riverina	E	HG	S	Federation x Volga barley ...	„ „ ...	Very early maturing.
Sands	E	HG	M	New South Wales farmer's selection.	Rust liable	Like Hard Federation; grain larger.
Saragolla	M	F	D	Mediterranean	Strong awns	Awns white or grey.
Shisen	M	G	...	Japan	....	Clubbed, tip-awned ear.
Sindhi	M	F	D	....	Red grain	Ear bluish-black with white markings.
Spelt (Black)... ...	L	F	P	Europe	Awned; very hard to thresh	Not grown commercially.

VARIETIES of Wheat recently grown at Cowra—*continued.*

Variety.	Season	Use	Class.	Origin.	Defects.	Distinguishing characters and good points.
Spelt (White)	L	F	P	Europe	Awnless; very hard to thresh.	Not grown commercially.
Spelz Marz	L	F	D	United States of America	Awned	Rust resistant.
Solid-straw Tuscan	L	HG	S	New Zealand	Rather too late; tends to shatter.	Semi-solid straw.
Stamina	E	HG	S	Federation x Thew	Straw medium strong	....
Stanley x Bobs	M	HG	S	Victoria...	Straw not so strong as Stanley x Yandilla King.	Brown, tip-awned ear.
Stanley x Yandilla King.	M	HG	S	,,	....	Brown, tip-awned ear.
Sultan	E	HG	S	South Australia	Starchy grain	Semi-solid straw.
Sun x Dawson	L	F	S	Vancouver Island	Too late for New South Wales	Dense, clubbed ear.
Super	L	F	S	United States of America	Too late for New South Wales; awned.	= Jones' Fife.
Talgai	E	HG	S	South Africa	Rust liable	Brown, tip-awned ear.
Union	E	G	M–S	Federation x Cowra 15	....	Brown, awnless ear.
Vanessa	E	G	H	Fife x Indian	Medium productive...	White, clubbed ear.
Wandilla	E–M	HG	S	Federation x Yandilla King	....	General purpose; white ear.
Waratah	E	G	S	Purple Straw x Gluyas	....	Brown ear, strong tip awn.
Warrah	E	HF	S	New South Wales Department crossbred.	Moderate grain yielder	Rust resistant.
White Australian	M	HG	S	United States of America	....	White, tip-awned ear.
White Federation	E	HG	M	Natural crossbred from Federation.	....	Like Hard Federation, but ear white.
White Queen...	L	F	S	England	Too late for New South Wales	....
Wickepin	E	HG	S	Western Australia	Straw sometimes contorted	Ears white, with tints of black.
Wild (Common)	L	F	P	Palestine	Rust liable	Ears extremely brittle.
Wild (Synthetic)	L	F	P	T. vulgare x T. durum	,,	,,
Wilhelmina	L	F	S	Denmark	Too late for New South Wales	....
Yeoman	L	F	S	England	,, ,,	Dense ears.
Yuna	E	HG	S	Western Australia	....	Rather like Gluyas; seems productive
Zaff	E	G	H	India	Straw not strong	Tip awned brown ear.
Zealand Blue	L	H	S	Western Australia	....	Has felted glumes.

Farmers' Experiment Plots.

GREEN FODDER TRIALS, 1922–23.

Yanco Irrigation Area.

A. N. SHEPHERD, Senior Agricultural Instructor.

THE undermentioned farmers co-operated with the Department in conducting various green fodder trials during the season 1922–23:—

J. George, Farm 484, Colando.
P. C. Moran, Farm 802, Gogeldrie.
R. Farrar, Farm 798, Gogeldrie.
W. Edwards, Farm 367, Leeton.
Messrs. Briggs, Farm 816, Leeton.
J. Seppel, Farm 138, Leeton.
J. Oslington, Farm 353, Leeton.
A. Cartmel, Farm 804, Wamoon.

The Season.

Very unfavourable weather was experienced for the growth of summer fodders. Light rainfall was recorded with the exception of a good fall in December. During the first four months of the present year only 30 points were registered. Hot strong winds blew in early spring and very high temperatures were experienced in February, the reading being over 110 degrees in the shade. Cool changes were experienced during the latter part of the summer, when readings were as low as 45 degrees Fah. The rainfall was as follows:—October, 88 points; November, nil; December, 251; January, 23; February, nil; March, 7; April, nil.

The Plots.

Farm 484.—A variety trial with maize was conducted on heavy red soil. Previous crop, oats, three seasons back; land since used as a grazing paddock. Ploughed in July; harrowed and cultivated in September. A fall of rain a few days before sowing rendered irrigation at that stage unnecessary. Seed was sown with the maize drill in furrows 3 feet apart on 4th October. at the rate of 20 lb. per acre with superphosphate at 70 lb. per acre. Only a fair germination was obtained. The crop was irrigated in November, December and January, twice each month. It was harvested for green fodder on 2nd February.

Farm 802.—Two trials were conducted on this farm, one with maize, and the other with sorghum. The maize was sown on 27th September, on red sandy loam. The land had been ploughed in July and September, and harrowed and cultivated previous to seeding. The seed was sown in rows 21 inches apart with a wheat drill, at the rate of 20 lb. per acre, with

superphosphate at 70 lb. per acre. The crop was irrigated on 13th October, 2nd and 21st November, and 17th December. A very nice even crop was cut and weighed on 22nd January.

The variety trial with sorghum was sown on 21st December on similar soil, which at this stage was rather "puggy," owing to the water breaking over it after the land had been irrigated and prepared for sowing. At first germination was only fair, but it evened up considerably later. The crop received five waterings.

Sorghum No. 61 gave the heaviest returns, but this can be accounted for by reason of it having given the best germination.

Farm 798.—The soil consisted of heavy grey clay. Two trials were carried out with maize sown in the spring and with sorghum sown later. In the case of the maize the land was ploughed in July, and after being worked down was irrigated previous to sowing on 10th October. Six varieties were tested, in rows 21 inches apart, with seed at 20 lb., and superphosphate at 70 lb. per acre. A very good germination was obtained. Cocke's Prolific made the quickest growth, while Large Macleay Yellow was the latest, being the last to tassel. The crop received three irrigations. It was cut and weighed on 8th February. Large Red Hogan was a little on the course side. Cocke's Prolific gives a nice fine stalk with plenty of leaf and good cobs. All varieties would be eminently suitable for the making of silage, being tall growers and heavy yielders.

The variety trial with sorghum was sown on 28th October, on land that had previously grown oats; it was ploughed in September, irrigated previous to sowing, and sown in rows 14 inches apart at the rate of 14 lb. seed and 70 lb. superphosphate per acre. The crop was rather patchy at the start, but evened up a good deal afterwards. The crop received seven waterings in all. It was harvested on 21st April, Saccaline giving the heaviest yield.

Farm 816.—Variety tests with maize and sorghum were carried out on this area. The maize was sown on 26th October, with superphosphate at the rate of 70 lb. per acre, on red loam land that had previously grown sorghum. The rows were 21 inches apart. Good germination was obtained, but much of the crop was destroyed by the first watering, the land watering unevenly and scalding consequently occurring in places. The crop received four irrigations. Owing to the thin stand, the yield was very light, but good quality fodder was obtained.

The sorghum trial was conducted on similar land, that had grown a crop of barley the previous winter. It was sown on 11th December, in rows 14 inches apart, at the rate of 14 lb. seed and 70 lb. superphosphate per acre. An excellent germination was obtained, and the crop made good growth. Sorghum No. 61 was the first to mature, but the yield was the lightest. The crop was irrigated once in January, twice each in February and March, and once in April.

MAIZE Variety Trials.

Variety.	Farm 798.				Farm 802.				Farm 484.				Farm 816.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Large Macleay Yellow ...	19	5	2	9					11	19	3	2	...			
Fitzroy	18	13	2	8	15	3	1	27	9	14	2	16	7	19	3	6
Cocke's Prolific	18	12	0	4	...				...				6	15	0	7
Large Red Hogan ...	17	16	1	8	...				...				7	8	0	18
Golden King	17	16	0	0	...				10	19	2	1	...			
Ulmarra Whitecap ..	15	16	0	26	...								6	12	2	15
Hickory King	...				16	8	3	20	8	17	1	4	...			
Leaming	...				16	0	3	14	...				...			
Funk's Yellow Dent ...	...				13	4	0	12	...				...			
Boone County White ...	...				12	13	3	25	8	15	0	0	...			
Pride of Hawkesbury ...	...				...				9	12	2	16	...			
Yellow Hogan	...				...				...				7	1	0	0

SORGHUM Variety Trials.

Variety.	Farm 798.				Farm 816.				Farm 802.			
	t	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q	lb
Saccaline .	19	15	2	0	22	11	3	12	16	16	2	3
Planter's Friend ..	14	15	0	2	16	17	1	27	15	19	2	16
Sorghum No 61	12	7	2	0	14	4	1	25	18	7	2	8

Farm 367.—A manurial trial with maize was conducted on this farm. The soil was a heavy red clay. Previous crop oats, with superphosphate at 56 lb. per acre. The land was ploughed in June, cultivated in September, and irrigated and cultivated before being sown with the double corn planter in rows 3 feet apart at the rate of 20 lb. seed per acre. Very fair germination was obtained. The crop received four waterings and was harvested on 25th January. The yields were as follows :—

	t.	c.	q.	lb.
Superphosphate, 140 lb. per acre... ...	9	12	3	12
Blood and bone, 1 cwt. per acre	8	18	3	17
P7, 126 lb. per acre	8	15	0	0
M5, 108 lb. per acre	8	9	2	16
Superphosphate, 70 lb. per acre	8	6	2	6
No manure	7	14	2	17
M6, 1 cwt. per acre	7	11	2	9
M7. 92 lb. per acre...	7	8	0	4

Farm 804.—A manurial test with Saccaline was conducted on grey soil on this farm. The land had been fallowed since early spring. The crop was sown on 21st November, at the rate of 14 lb. of seed per acre, in drills 14 inches apart. Good rains fell just as the seed was germinating, resulting in a perfect strike, and the crop made very rapid growth. It was watered at the end of December, in the middle of January, at the beginning and end of February, and once in March. It attained a height of 12 feet and was very even throughout. The yields were as follows :—

	t.	c.	q.	lb.
M6, 1 cwt. per acre	26	1	3	4
Superphosphate, 70 lb. per acre	25	6	0	18
M5, 106 lb. per acre	25	4	2	18
No manure	23	14	0	22

Farm 138.—A method-of-sowing test was carried out with Sudan grass on this holding, at the distances between rows and rates of seeding indicated in

the table given below. Superphosphate was applied at the rate of 70 lb. per acre. Lucerne had previously been grown on this land, which was ploughed in July, cultivated in August, and harrowed previous to sowing on 19th September. Good germination resulted. The crop was watered three times and was cut and weighed the first week in January. It will be noted that the heavy seeding in drills 7 inches apart gave the heaviest yield. The second growth was similar to the first; no weights were taken, but the crop was grazed with cows.

	t.	c.	q.	lb.
7 inch drills, 12 lb. seed	3	10	2	14
7 inch drills, 10 lb. seed	3	7	1	16
14 inch drills, 10 lb seed	3	3	3	26
35 inch drills, 10 lb. seed	2	7	0	16
35 inch drills, 6 lb. seed	1	17	1	8

Farm 353.—A manurial trial with Sudan grass was carried out on a red loamy soil that had previously grown a crop of oats. The land was ploughed in July, cultivated in August, and harrowed and cultivated in September. Sowing was carried out on 11th October, at the rate of 10 lb. seed per acre, in drills 7 inches apart. A very good germination resulted. The crop was watered on 28th October, 15th November, and 4th and 19th December, and harvested in the first week of January, green weights being taken. All manured plots it will be seen, gave considerably heavier yields than the unmanured.

	t.	c.	q.	lb
Superphosphate, 140 lb. per acre ...	4	2	2	0
Superphosphate, 70 lb. per acre	3	0	2	0
M5, 105 lb. per acre	2	17	0	16
M6, 112 lb. per acre	2	17	0	0
P7, 126 lb. per acre	2	12	0	2
No manure	2	2	0	0

The fertiliser mixtures referred to above are made up as follows:—M5, two parts superphosphate, one part sulphate of ammonia; M6, five parts superphosphate, three parts chloride of potash; M7, ten parts superphosphate, three parts chloride of potash; P7, equal parts superphosphate and bonedust.

To Make Asphalt Paving.

The materials used for ordinary asphalt paving for floors, &c., are blue-metal, broken to a 1½ or a 1 inch gauge, screenings of the same, sand, and coal-tar. Twenty-five gallons of tar are required for each cubic yard of metal, &c. The lower thickness (usually about 3 inches) is of the larger stone. It is topdressed with the screenings and sand to a depth of 1 inch, this topdressing being rolled down hard on to the metal.

The method of laying is much the same as for cement concrete. The surface to be paved should first be carefully graded off, any soft spots being rammed solid. The mixture should be well prepared, the ingredients being thoroughly mixed together, and spread and tamped into position to the required levels. Topdressing for asphalt consists of hot tar spread with sand.

A cheaper paving consists of sifted furnace ashes in lieu of the metal, topdressed either with the blue-metal screenings or sand and tar only, the latter constituting the cheaper job.—A. Brooks, Works Superintendent.

Soil Organic Matter.

THE SIGNIFICANCE OF LEGUMES.

H. WENHOLZ, B.Sc. Agr., Special Agricultural Instructor.

FARMERS often inquire as to whether the ploughing in of weeds as green manure is not as good practice as ploughing in a legume which has been specially grown for the purpose. Experiments in New South Wales have shown that better results usually follow green manuring with a leguminous crop than with a non-legume under most conditions, but no reasonable explanation of these results has ever been given.

Considerable light is now thrown on the matter by some work carried out at the Washington (U.S.A.) Agricultural Experiment Station. It has been found that* the nitrogen-carbon ratio in soils, irrespective of their origin, is practically a constant, and tends to remain so. Taking carbon as an index of the organic matter in the soil, this indicates that the soil organic matter cannot be increased, or even maintained, unless the necessary nitrogen is provided.

Further, it has been shown† that the nitrogen-carbon ratio in the material returned to the soil has a very pronounced influence on the kind and rate of decomposition. Organic material like non-legume straw, having a wide nitrogen-carbon ratio (1 to 75), has a depressing effect on nitrate development when applied to the soil, and such effect is seen until there has been sufficient decomposition to cause the ratio to approach that of the organic matter in the soil. On the other hand, where organic matter having a narrow nitrogen-carbon ratio (1 to 10), like legume hay or legume green manure, is incorporated into the soil, there is an immediate and rapid nitrate development. There is also less loss of carbon dioxide (CO_2), and an indication of greater maintenance of organic matter.

These discoveries emphasise the superiority of the legume for green manure for supplying organic matter, and also in those cases where it is desired to increase the available nitrogen in the soil, as in cold districts or with winter crops where nitrification is naturally slow, but also in warm districts with a good rainfall, where the nitrogen has been depleted by leaching. Where cultivated crops like maize and potatoes are largely grown the loss of organic matter is greatest, and it seems from these discoveries that leguminous crops must be grown if the yields of the main crops are to be maintained. Whether the legumes are used for green manuring or fed off by stock will have to be determined by the individual farm economy.

In our wheat belt we have generally found that a wheat crop on stubble land has yielded better after the burning or removal of the straw stubble

* Washington Agr. Expt. Stn., Bull. 176 (1923).
† Washington Agr. Expt. Stn. 31st Rept. (1921).

than when the straw stubble was ploughed under. We have, in the past, ascribed this difference very largely, if not solely, to the insufficient consolidation and moisture-holding capacity of the sub-surface where organic matter difficult of decomposition was ploughed in, but the bulletin referred to gives a further reason for the difference. The reduction in yield is ascribed to the transformation of nitrogen already available for plant-food into a non-available form. It is stated that the application of straw to the soil stimulates the increase of bacteria, which use the straw as a source of carbon and the nitrates in the soil as a source of nitrogen. The nitrates are transformed into organic nitrogenous material, and for the time being are lost as available plant-food. The more straw applied the greater is the loss of nitrates. Nearly all of the carbon is lost as carbonic acid (CO_2), and with its loss non-leguminous crop residues like straw cannot be materially depended on to influence the soil organic matter. Paradoxical though it may seem, the return of organic matter to the soil in the form of wheat or oat straw does not apparently increase the soil organic matter any more than burning the straw under these conditions.

In hot, dry districts, where nitrogen losses from the soil are light, it is thought that there may be sufficient free fixation of nitrogen for maintaining, or even increasing, the soil organic matter. This would explain, further, why fallowing in such districts is to be preferred to even rotation cropping.

Two Valuable Grasses.

"I HAVE about 2 acres of Tall Oat grass and 3 acres of *Phalaris bulbosa* planted on some of the lower ground on this property," writes Mr. Gordon Henderson, "Strathnoon," Borenore. "The soil is of a fairly light nature and very nearly pipeclay in places. So far (over three years) I have been extremely pleased with the growth of the Tall Oat grass. It matured very soon after planting, and during last spring attained a height of well over 3 feet. The summer and autumn in this district has been the driest on record. No rain fell in November. The registration for December was 348 points, January 92, February nil, March 91, April nil, and May 115. During the period the Tall Oat grass showed no sign of the dry season and kept growing right up until the very cold weather and heavy frosts set in. It has not browned off in any way through snow or frosts, and is now providing me with feed sufficient for large stock.

"The *Phalaris bulbosa* was very slow in becoming established, and even at present is still rather backward. It has, however, provided very nearly as good green feed as the Tall Oat grass, and now, during the extremely cold and wet weather experienced here during the winter, is growing a little more than the Tall Oat. The *Phalaris bulbosa* also showed no signs of the dry spell experienced.

"The stock do not seem to show any preference for either of the grasses, and readily graze on them. Of over twenty different grasses tried on this property, Tall Oat grass and *Phalaris bulbosa* stand out as the most suitable. They can withstand a dry spell, and provide a very fair amount of fodder for stock during the period of winter when all other pastures are bare and showing no growth at all."

A Discussion on Neutralisation.

H. D. BARLOW, Senior Dairy Instructor.*

NOTWITHSTANDING the fact that the quality of New South Wales butter has improved to a very great extent during the last few years—so much so, in fact, that during the last export season we have had reliable reports stating that our best brands on the London market more than hold their own with Danish and New Zealand in point of flavour and manufacture—I think that we could still give a little more attention to the question of neutralisation.

Apart from a very large possible improvement of our raw product (cream), which is only partly under the control of the factory manager, our best chance of making even a better article than we do at present is a thorough knowledge and understanding of the technique of butter-making, and particularly of neutralisation. In my opinion, this very necessary process is still, in many cases, not given the amount of consideration which it warrants, and is very often the direct cause of a distinct variation in butter quality, thus helping to prevent the manufacture of a uniformly excellent article, which should be our ultimate aim.

All my remarks in this paper apply particularly to neutralising with bicarbonate of soda ($NaHCO_3$), which at the present time is practically universally used in New South Wales. The questions which have occurred to me, and which I have endeavoured to answer satisfactorily, are as follow :—

1. What is the correct acidity to which cream should be neutralised for all general conditions ?
2. Has the amount of acid allowed to remain any decided effect on the flavour of the butter, or does this depend on the flavour of the cream before neutralising ?
3. Have the method of mixing the neutralising agent, the temperature of the water it is dissolved in, and the temperature of the cream when it is added, any effect on the flavour of the butter ?
4. Has the original amount of acid in the cream any direct bearing on the correct neutralising acidity ?

The Correct Acidity.

During the past year I have had occasion to make a considerable number of experimental butters from cream which had been neutralised to neutral and to varying stages of acidity up to ·25 per cent. acid. During the course of these experiments, and as a result of personal observation and inquiries at different factories, I have been endeavouring to arrive at the most satisfactory method and the correct neutralising acidity, and having noted the results

* Paper read at the Conference of New South Wales Co-operative Butter and Cheese Factory Managers and Secretaries, Sydney, June, 1923.

obtained at different factories, and compared them with my own experience, I am of the opinion that ·25 per cent. of acid is the highest which should remain in the cream after neutralising, and that ·1 per cent. of acid is the lowest amount. Although there is not sufficient evidence available from specially checked samples absolutely to prove my contention, I would suggest that under almost all conditions the most favourable neutralising point both for flavour and keeping quality is a true acidity of about ·15 per cent. to ·2 per cent. acid.

As no doubt a number of managers have themselves formed decided opinions on this point, I think it is well worthy of serious discussion at this conference. My experience points to the fact that if cream is neutralised, even very carefully, to below ·1 per cent acid, there is considerable danger of an alkaline flavour being noted. The butter is at first usually flat and insipid, and seems to lack the true butter flavour, which, in my opinion, is responsible for it grading at least one point lower in flavour than the original cream warranted—in other words, cream which should have made a butter worth easily 43 to 44 points for flavour would be graded bare 43 points. In several cases which I have had under observation, these very low acid butters have shown a tendency to become tallowy during storage.

If acidities above ·25 per cent. acid are used the resultant butter will not keep well, and has a tendency to be "oily," with no appreciable increase of "brightness" in flavour when fresh. These butters also tend to develop tallowiness during storage.

As everyone is no doubt aware, it is practically impossible to obtain a true acidity when using bicarbonate of soda unless the carbon-dioxide (CO_2) is driven off by boiling the sample. Although an approximate result may be obtained after the cream has gone over the second cooler (flash system), this is not absolutely reliable, and it will generally give a higher acid reading than is correct, the variation being usually from ·02 to ·05 per cent., or even more. With the batch system of pasteurising, the results are even more inaccurate.

Effect of Acidity on Flavour.

With regard to this question, I have not yet been able to obtain any definite proof, as the bacterial content of the cream, both before and after pasteurisation, must have such a large controlling effect, but my experience goes to show that the flavour of the finished butter is determined by the original flavour of the cream, and allowing more or less acid to remain in the cream does not appreciably affect it, unless extremes are taken, when, a previously remarked, the results will probably be detrimental.

The Possible Effects of Method on Flavour.

In a paper read at this conference last year I laid considerable stress on the value of mixing the neutralising agent properly, and I still contend that the more completely and quickly the neutraliser is mixed with the cream the better the results. About one gallon of water to 1 lb. of soda is a good mixture.

Although I have not seen much attention drawn to it before, the temperature of the water used and the temperature of the cream when the neutraliser is added seem to be very important points, probably on account of the chemical change which takes place and its effect on the flavour of the butter.

The water used for mixing the soda solution should on no account be more than 100 deg. Fah., and preferably colder, as if too hot a rapid chemical change takes place, the CO_2 is released, and the bicarbonate is changed into carbonate of soda.

Pure bicarbonate of soda has a very mild alkaline flavour and action, but carbonate of soda (washing soda) has a much more powerful flavour and action, and, although their neutralising effect is the same, the action of the latter is much more severe and seems to have a detrimental effect on the flavour, probably due to more or less saponification of some of the fats.

If water between 120 and 130 deg. Fah. is used, my experience is that there is a danger of reducing the flavour quality of the butter one point or more If, as is often the case, almost boiling water is used, this reduction may be increased, and, although the butter may not be put out of its grade, it is my contention that cream which under good conditions would probably produce a good, choice, well flavoured butter, grading about 44 points flavour, may be graded bare 43 points and designated bare common "choicest."

In very many cases when the batch system of pasteurisation is used, the cream is allowed to become too hot before the neutraliser is added, and the result is probably much the same as using hot water to dissolve the soda. I do not wish to infer that the heating should not be started before the soda is added, but it is not advisable to have the cream more than 80 to 90 deg. Fah. In winter time especially, a small amount of forewarming is advisable, as the cream is made less viscous, and it is, therefore, much easier to obtain a quick and complete mixing of the neutraliser. It is not advisable, however, to go beyond the temperatures quoted, as, if it does so happen, the cream will swell instantly to a much larger extent than is normal, and the butter invariably has a "flat, foreign" flavour, which, although not particularly objectionable and possibly not very harmful, still has the effect of decreasing the natural flavour value to a certain extent, and this condition of things is to be constantly guarded against.

Using damp soda or soda which has been exposed to the air for some time, and mixing the soda in bulk some time before it is required also seem to tend to impart this foreign flavour to the butter.

The Relation of Original Acidity to Pasteurising Method.

Although I have very often heard it stated by persons with a large experience that high acid cream cannot be brought to as low an acidity as sweeter cream before pasteurising, the reason usually stated being that the high acid cream will not stand the amount of soda necessary on account of the danger of producing a soda or alkaline flavour, I do not agree with this statement. I consider that if the amount of acid and neutraliser have been

correctly estimated, the only danger from using the larger amount of soda would be brought about by not diluting it sufficiently and not mixing it properly. My experience has been that no matter how high the original acid may be, if it is desired to reduce it to, say, ·15 per cent., there is no likelihood of danger provided it is properly done, but, naturally, if proper care has not been taken with the different estimations and mixing, the large amount of soda necessary will be more likely to produce a decidedly detrimental effect.

Although, as I have mentioned several times, I have not yet sufficient data to be able definitely to state facts, still I have tried to give an idea of what the data I have been able to obtain seems to disclose, and the more I go into the matter the more important it appears to me that the process of neutralisation should be taken a lot more seriously than it generally is. I am strongly of the opinion that, although it may not cause many major faults in butter, it is very probably responsible for a large quantity of what I would term very weak choice butter. It seems to me, also, that it is quite time that we were able to lay down definitely a certain neutralising point and method which would consistently give the best results, and although it may be that the best neutralising point will vary slightly under different climatic conditions, &c., it is in the hope that factories will endeavour to prove these matters to their own satisfaction, and thus enable the dairying industry of New South Wales to obtain some very useful data and ultimately, I hope, bring about the manufacture of a uniformly excellent butter all over the State, that I have brought these matters up for consideration. To some of you, I may not have said anything new; still, I hope that you will consider the facts worthy of a little thought, and that perhaps, in part at least, my suggestions may be a help to others.

"OUT-DOOR PIGS."

THE sub-title of this book, "How to make them pay," suggests its strictly commercial vein. The work consists of a number of articles on various aspects of the subject by leading authorities on modern pig-keeping. It is, therefore, not a collection of theories, but the solid experience of several men well qualified to deal each with his own phase of the matter. As the book itself reminds us, "the experience of others is always useful, and it may be, therefore, that in reading through these pages even the most successful and well-informed pig-farmer will be able to find something interesting and profitable." The first article describes the outdoor pig under British conditions, and others deal with the selection of the stock, management of the herd, foods and feeding, arable pig farming, huts and fencing, marketing, and so forth. A statement of the points of the different British breeds, as issued by the various societies, is a useful feature. Though prepared for such different conditions from those of this State, the book contains much that is useful and suggestive.

Our copy from the publishers, the Rolls House Publishing Co., Ltd., London.

Conditions Favourable to Cotton Culture.

Climates and Soils in New South Wales.

H. WENHOLZ, B.Sc.Agr., Special Agricultural Instructor, and
E. S. CLAYTON, Agricultural Instructor.

CERTAIN climatic conditions are necessary for the profitable production of cotton, viz., a relatively high temperature, a long growing season with a large amount of sunshine, a moderate and well-distributed rainfall, especially during the growing season, and a relatively small amount of rain during the picking season.

In the United States of America it has been found that the northern limit of the cotton belt has an average summer temperature of 77 deg. Fah., and a period of at least 200 days free from frosts. The annual rainfall in the cotton belt varies from 23 to 60 inches, the precipitation over most of the area being 30 to 50 inches. The districts in New South Wales which approximate these conditions are parts of the North Coast, parts of the North-western Slopes and of the Upper Hunter, small portions of the Central-western and South-western Slopes, and the Murrumbidgee Irrigation Areas, where the natural rainfall can be supplemented by irrigation.

The optimum conditions for cotton production are found where a mild spring, with light but frequent showers, merges into a moderately moist summer, warm both day and night, followed by a dry prolonged autumn. If the weather is too cool in the spring the growth is retarded, and too much rain in the spring may induce the seed to rot rather than germinate. Drought in spring often kills the young shallow-rooted seedlings. A wet summer promotes vegetative growth at the expense of boll production, and favours the growth of weeds, while drought causes early maturity and reduces the yield, as also does a spell of cold weather. Rainfall of the thunder-shower type, with warm bright days between rains, is ideal; plenty of sunshine is especially beneficial while the plants are in bloom.

Where the rainfall during the picking season is excessive much cotton will be spoiled. Very rainy weather, when the cotton is maturing and the bolls are beginning to open, retards maturity, interferes with picking, and discolours or damages the exposed cotton. In a dry autumn the greater daily range in temperature is also favourable to the maturing crop, as it checks vegetative growth and induces fruiting. In the cotton belt of America, autumn is the driest season of the year, practically all important cotton regions receiving less than 10 inches during the autumn months; those districts receiving more than 14 inches during these months are considered unsuitable.

It has been frequently asserted that cotton is a very drought-resistant crop, and that it does not require much rainfall during its growth. Cotton certainly stands more dry weather than maize, but there is a certain limit beyond which cotton is considerably affected. Cotton is not suited by a very dry atmosphere unless there is sufficient moisture in the soil. If it is long continued, dry weather has an injurious effect on the crop in checking the production and growth of the bolls, and in causing short or weakened fibres which are of little value for manufacturing purposes.

A cool autumn causes the plant to lose much of its growing vitality; the young bolls cease to develop and produce immature cotton called "bollies." In districts with too short a growing season, or with late-sown crops in other districts, a good showing of bolls may often be made, but the cool weather that occurs in the autumn results in the production of a large number of these "bollies," many of which never mature sufficiently to be picked.

Prolonged drought is a greater danger to the long-stapled cottons than to the short-stapled varieties, as the former require continuous growth to secure uniform length and strength of fibre. This greater requirement of long-staple varieties limits their cultivation to the more favourable districts.

Suitable Soils

Cotton will thrive on a wide variety of soils. Provided the soil is fairly deep, well drained, and of moderate fertility, cotton can be successfully grown on soils ranging from light sandy loams to heavy clays. The drainage is of the utmost importance—cotton will not thrive in cold, wet, or shallow soils.

The best yields of cotton are obtained mostly on fertile, well-drained, alluvial, or good volcanic soils, but in some districts payable crops are grown on soil of only moderate fertility. While cotton will grow on almost any soil, it does not follow that it will be equally productive on any. Although the plant will grow on very poor soils, the yield on that class of country is too low and the staple too short to make the undertaking profitable.

Cotton is somewhat drought-resistant, but to get the best results a fairly regular supply of moisture in the soil is necessary. For this reason, very porous soils, which dry out rapidly, are not suitable, unless in a district of good rainfall.

The heavier the rainfall in any district, the poorer the soil which can be utilised for growing cotton. On these poorer soils, with good rainfall, fertilisers will probably be necessary to make a profitable crop. A very rich alluvial soil in a district of good rainfall is often a disadvantage, because heavy vegetative growth is induced to the detriment of boll production. In districts of low rainfall it is only the most fertile soils which can be expected to retain sufficient moisture and ensure sufficiently uniform growth to produce a good crop.

Suitable Districts in New South Wales.

The districts in New South Wales which most closely approximate the climatic conditions described are:—

(1) The Upper Richmond River district, from about Casino northward.

(2) The Clarence River district, especially the upper portions from about Grafton to Tabulam, with the possible exception of the lower Clarence.

(3) The Hunter Valley (alluvial soils in districts of good rainfall).

Profitable crops have already been grown in these districts, but there are a number of other districts in which the climatic conditions appear to approximate the necessary requirements, and which may possibly grow cotton successfully, but in which further experiments are necessary to demonstrate the profitableness or otherwise of the crop. These are as follows:—

(4) The Bellinger, Nambucca, Macleay, Hastings, and Manning River districts, with the possible exclusion of the lower parts of these rivers.

(5) Murrumbidgee Irrigation Areas.

(6) Parts of the counties of Cumberland and Northumberland.

(7) Hawkesbury River district.

(8) North-western Slopes—alluvial, volcanic, or good, deep, sandy loam soils, with a minimum annual rainfall of approximately 25 inches, comprising the Macintyre, Gwydir, Namoi, Manilla, and Peel River districts.

(9) Central-western Slopes—alluvial soils, with a minimum annual rainfall of approximately 25 inches, comprising the Castlereagh, Macquarie, and Lachlan River flats.

(10) South-western Slopes—alluvial soils with a minimum annual rain fall of approximately 25 inches, comprising the Murrumbidgee and Murray River flats.

Even in these parts of the State, in addition to the rainfall requirements, there must be a mean summer temperature approximating 77 degrees Fah., and about 200 days free from frost. Where the average annual rainfall is much below 25 inches and the other climatic requirements are present, good yields of cotton may possibly be obtained in favourable seasons, but the crop will probably be too precarious under normal conditions, and is therefore not likely to become popular.

It is considered that the rainfall on the Tweed River is too high for successful cotton growing; this applies also to the "big scrub" country between the Tweed and the Richmond Rivers, as well as to the lower part of the Richmond River district. The climatic factors which ensure an unrestricted growth of paspalum make for successful dairying, and would easily militate against the cultivation of cotton. The excellent climatic and soil conditions on the Tweed and Lower Richmond also favour the growing of sugar-cane,

from which excellent returns are obtained. It is on the volcanic soils of the Upper Richmond, from Casino northwards, that profitable crops of cotton have already been grown.

On the Clarence the rainfall is lighter. The lower part of the river may possibly receive too much rain during the picking season, and the good returns obtained from sugar-cane preclude the possibility of cotton ever being largely grown on this portion of the river. Some very good crops have been grown on the alluvial soils on the middle and upper parts of this river.

The higher temperatures in the Hunter Valley are distinctly favourable to cotton, but the crop will have to be confined mostly to the alluvial soils on account of the light rainfall, and even there winter fallowing and good cultivation methods will be necessary to grow cotton under natural conditions. On irrigable land the application of water would ensure success, but under these conditions lucerne-growing is not likely to be largely displaced.

SILAGE *versus* HAY IN SEASONS OF HEAVY GROWTH.

ALMOST invariably a season of prolific growth follows the breaking of a drought. Crops grow coarse and rank and are inclined to lodge, especially on the heavier soils. It also often happens at such times that the weather during harvest is broken, and harvesting operations—particularly hay-making—are greatly retarded thereby. The hay in such seasons is frequently of poor quality, the result of coarse growth and of the discolouration caused by rain-storms during curing.

It is quite possible that the current season will present these same features, and it is wise for the farmer to employ methods that will at least mitigate the losses that attend ordinary harvesting methods. This can be effectively and profitably done by cutting largely for ensilage, and conserving as a succulent and valuable fodder what (if cut for hay) would prove a feed of comparatively low value and much more costly.

The numerous hay-stacks in this district, made from the 1920 season's crop and still unused, bear witness to the low feeding value of such hay, the recent drought having caused prices for any hay of reasonable quality to be sufficiently remunerative for the holders to put it on the market. Had this hay of poor quality been cut at an earlier stage and ensiled, the cost to the farmer would have been much less, the value of the stored fodder very much greater, and the risk of damage by wet weather, mice or other destructive agents avoided, while at the same time the making of the silage would have been completed before the grain harvest was commenced and no delay would have occurred in waiting for horses to draw the headers. As practically all farmers now keep a flock of sheep besides some cattle, the silage would be more valuable to them, and any hay required for horse feed could be cut and stacked from crops of better quality in average seasons.

The article, "Conservation of Fodder—Pit Silage for Starving Stock," published in last month's *Gazette*, is most comprehensive, and if he follows it no farmer need fear being unsuccessful in making silage. On the other hand, it will be found that by resorting to this method of conserving fodder in seasons of exceptional growth very much less waste in farm crops will result.—H. J. KELLY, Manager, Cowra Experiment Farm.

Tobacco-growing in New South Wales.

C. J. TREGENNA, Tobacco Expert.*

THREE types of tobacco are grown for commercial purposes, viz., Turkish, cigar leaf, and Virginia, for pipe and cigarette.

In Australia it is the last for which a market exists. For many years tobacco has been grown in New South Wales. The first official record I have seen was for the year 1861, when 224 acres were under crop. Apparently various centres have existed where it has been largely grown in the past. The Paterson River was possibly the first, then the Maitland district, then Texas, on the Queensland border, and of late years the Tamworth district. The last is now the district producing the largest quantity of leaf—probably 1,200 to 1,500 tons this year. From information I have obtained from old growers, it would seem that a disease known as blue mould was the primary cause of tobacco-growing shifting from one place to another. It appears to me that this disease gets more virulent the longer tobacco is grown in one place or district. Wet weather during the early spring without doubt induces the pest, and no place has yet been found that is free from it. Primarily it is a disease of the seed-bed, and no methods of control have yet been discovered.

The tobacco plant is very adaptable to most classes of soil, but that grown on light sandy loam soils is, as a rule, fine in texture, bright in colour and not strong in aroma. Its yield and habit of growth is, nevertheless, affected by climate and methods of cultivation.

Soil and climate are the main factors for the successful tobacco planter. In general, greater heat is necessary for the production of aromatic tobacco suitable for cigars. Pipe and cigarette leaf is grown in the warmer portions of the temperate zone. As a general rule of universal application, good smoking leaf cannot be produced in close proximity to the sea coast, as the "burn" of the tobacco is injuriously affected by the presence of chlorides in the atmosphere and soil. To be acceptable to buyers, the cured leaf must hold fire steadily and evenly without a tendency to "coal" or "carbonize" in advance of the actual burning area, and it must have a pleasant burning aroma.

It should be noted that each country produces a tobacco having its own distinctive burning aroma. Seed from one place acquires the particular aroma of the country it is grown in and transferred to. If Havana seed is planted in Manilla the leaf assumes the aroma of Manilla, and so with regard to American seed planted in China, Rhodesia, Australia, and elsewhere.

America was the original home of the leaf now mostly smoked throughout the world. Its particular aroma has become the standard. Australia has its own aroma, and being different from American is not readily adopted by the public.

* Paper read at the State Conference of the Agricultural Bureau of New South Wales, held at Hawkesbury Agricultural College, Richmond, 19th to 22nd June, 1923.

Leaf recently produced and properly cured in the cooler portions of the State has given us most promising results, and having smoked the manufactured article, I think it should be acceptable to many of the public so far as the burning aroma is concerned.

One man can work 4 acres of tobacco with a little help at harvesting time, and if the product is properly flue-cured he may expect a net return of £120 per acre. It must be remembered, however, that tobacco is a crop which requires patient and unceasing labour, and sedulous care from the time it is sown in the beds until the time it is sold. Very little of the work can be

A Crop of Tobacco at Tamworth, February, 1923.

done by machinery, and to fetch a high price it must be cured in a barn with flues—an operation that can only be successfully carried out with leaf at the correct stage of maturity and by a man of experience, who can ensure the correct range of temperature day and night for some six days. He must adopt, too, the treatment necessary for the particular requirements of the leaf in the flue-curing barn.

Tobacco is a crop which is even more sensitive than most others to the presence of weeds, and if these are allowed to get ahead in the young crop it receives a set-back from which it never wholly recovers, no matter what means are adopted to restore the crop.

The point which emerges from these remarks is that it is a mistake for a man to endeavour to cultivate a large area, unless he can command suitable and efficient labour. From the time the tobacco is planted out, there is weeding, topping, and suckering to attend to and in addition in some cases irrigation has to be carried out, while attacks by caterpillars have to be controlled. Tobacco, therefore, being very sensitive to climatic conditions, is

to be regarded rather as a side-line than as a sole revenue-producer to the man on the land. It is a highly remunerative side-line, however, and in the area indicated bids fair to become an attractive investment to those who find pleasure in devoting part of their energies to intensive culture.

So far as can be observed—and subject to the correction of the future—the most promising portion of this State for the production of leaf more closely resembling that imported from America lies in the area Tumut to Wagga and south thereof. It will be seen that this embraces the cooler portions of New South Wales. Some years ago, after a very good dinner, the opinion was expressed by an enthusiastic gentleman that Texas, on the Queensland border, would prove to be the Virginia of Australia. Without having had such a good dinner I opine that the Upper Murray and its surroundings will prove to be the place where we can offer competition with American leaf. There we have the colder winter and the cooler nights during the growing and harvesting season. I do not say we shall ever produce the same burning aroma as American leaf, any more than that country could produce the Australian aroma from our seed in Virginia, but I do feel that the time is not far distant when we shall at least compete with leaf so largely imported now.

Every encouragement is given by the principal buyers to growers here to produce flue-cured leaf. The prices paid are remunerative, and I do not think growers can justly complain of any hard treatment. Only the manufacturer can tell you what happens to the cured leaf after it leaves the grower to appear again in those neat tins containing such uniform products, each smoker adopting his own particular brand and gaining unalloyed joy and solace from it, at least so I judge from the happy and contented physiognomy of smokers.

September Work in the Apiary.

With the stimulating effect of spring conditions the bees will go in for intense brood-raising during this month if the weather is favourable, and to get the best results the question of stores becomes of more and more importance. Colonies with any prospect of starvation cannot be expected to raise the quantity of brood required. The bee-farmer should provide stores by equalising supplies, *i.e.*, removing combs of honey from those having a heavy surplus and supplying the needy ones, or by feeding sugar syrup. Another important point often overlooked by the beginner is to see that the queen has good brood combs to lay in in the brood nest. It is surely distressing for a queen desiring to build up a population of worker bees to be confronted in the brood nest with a comb containing practically all drone cells. It is rather distressing to the bee-farmer, too, to find almost as many drones as worker bees in the hives. If the bees are established in the supers, do not remove them down too early in the season, for the top of the hive is the warmest place, and the weather is usually changeable at this period.—W. A. Goodacre, Senior Apicultural Instructor.

Extravagantly Advertised Commercial Fungicides, etc.

From time to time specifics are placed upon the market for which claims are made that are quite extravagant. When, for instance, it is asserted that a particular specific will destroy all fungoid and garden pests, make sick trees healthy, cure bunchy top in bananas, and kill cutworms, the plant pathologist accepts the statement with reserve. He knows that the possibility of the same stuff effecting all these things is exceedingly remote.

To discuss fungus diseases alone for a moment, the pathologist knows that each disease has its own peculiar life-history, upon a knowledge of which must be based both method and time of treatment. Fungi are particularly subject to variations in climatic conditions, and a few bright dry days will often check a fungus disease far more effectively than any specific. No judgment about any treatment can be formed, therefore, unless untreated plants, growing under exactly the same conditions, are used as a means of comparison.

Similarly, if a preparation is to be added to the soil in order to promote growth, no judgment can be formed about it unless treated and untreated plants are grown in adjacent plots under conditions exactly alike in all other respects.

The questions of fungicides, of bacterial life, of fertilisers, and so forth have been the subject of extensive investigation in recent years at the hands of plant pathologists, and the principles involved have been carefully studied.

Growers are, therefore, warned not to accept too readily the reports of successes with new secret remedies, and if it is decided to try them, proper checks should be kept with untreated plants or plots, in order that proper comparisons may be made.—G. P. Darnell-Smith, Biologist.

"A Home Vegetable Garden."

"You ought to own a garden." So encouragingly begins this book of 214 pages, in which the writer, Ella M. Freeman, presents in a chatty form a thousand suggestions about the starting and the care of a vegetable garden. There are no burdensome technicalities; on the other hand, a light fluent readable account of things that the too well informed student of agriculture may consider elementary, but that can only charm and engage the less erudite.

To this lady it is not merely the produce of her garden that is hers. She is the possessor, too, of the sweet scents ("do you know how fragrant a cucumber blossom is," she asks, "so fragrant, it fills its place in the garden full of perfume, when the dew forms at night"), the songs of the birds, the shadows on the hillside, and the sounds of the breezes in the trees—all these are hers. In this fresh, convincing vein she describes the laying out of the garden, the manuring of the ground, the control of insects and diseases, and finally the cultivation of a score of favourite features of the vegetable garden.

Our copy from the publishers, the Macmillan Company, New York.

Poultry Notes.

SEPTEMBER.

JAMES HADLINGTON, Poultry Expert.

IT is fortunate that at the commencement of the hatching season the prospects of poultry-farmers have considerably brightened; first, by the falling prices of foodstuffs, and, second, by the fact that egg prices are being maintained at a somewhat higher level than was anticipated a couple of months ago.

About the end of June and early in July something in the nature of panic seized the egg market, with the result that a slump occurred that caused some consternation among poultry-farmers. All sorts of theories were propounded to account for the sudden fall in prices. In some quarters it was alleged that there were largely increased supplies, yet scarce any individual poultry-farmers would own to his hens laying more than expectations for the time of the year.

Another allegation was that there was a large increase in flocks. This, again, was at variance with the figures supplied by the Government Statistician, which showed that there was a decrease in numbers of birds kept in the State to the extent of 400,000, as compared with the previous year. This being the case, it is difficult to see how there could be an increase in production. It is, therefore, safe to assume that there was no increase, and that the demoralisation of the market was due to other causes.

Yet another alleged cause was the quantity of cold-stored eggs to be disposed of. The fact that inside of two weeks from the sudden fall in prices—and in face of a seasonal increase in production—there was a return to higher prices, which were normal for the time of year, shows conclusively that the big slump was due more to panicky conditions than to any other cause. If proof of this were needed, it would be found in the fact that whilst eggs were said to be in over-supply the public were scouring the countryside to secure their requirements. The fact was that the continual anticipation of such falling prices as were not likely at the time of the year kept grocers from operating on a sufficiently large scale to supply the requirements of the public. The writer is convinced that neither over-supply nor cold-store eggs had anything to do with the trouble.

The effect of the allegation that cold-store eggs were the cause of the fall in prices was to cause many poultry-farmers to inveigh against cold storage, and to join with consumers, who have already an unwarranted prejudice against cold-store eggs as such.

This brings us to the question of the benefits or otherwise of cold storage of eggs. It is a practice that surely does not need defence in the twentieth

century. The benefits arising out of cold storage of foods have been inestimable. Yet we have at the present time people who are ready to deprecate it in one way or another.

These prejudices have led to a demand that such eggs be branded. If this demand was confined to the consuming public one could, to some extent, understand their point of view, but that the poultry-farmer should join in the cry is not so easy to understand. There can be no doubt that the interests of both consumer and producer lie along the line of a moderating of the extremes of prices between summer and winter. In this lies the hope of increased consumption, and it is only by a legitimate use of cold storage that it can be brought about. We cannot bridge the plentiful and the scarce seasons of production in any other way.

What the poultry-farmer should realize is that if by cold storage he can secure 2d. per dozen more for his eggs in the season of plentiful production, it is the equivalent of at least 8d. per dozen during the months over which cold-store eggs are in competition, more or less, with the new-laid product. If this is the case the poultry-farmer should welcome cold storage, as an economic blessing.

This brings us to the question of branding of cold-store eggs. On the point of commercial integrity, no one can defend the selling of cold-store eggs as new-laid. Doubtless it does sometimes occur, but eggs three weeks old are also sold as new-laids. It is well known among experts that eggs stored when quite fresh are infinitely better quality when brought out of storage than are the stale eggs referred to.

The fact in this connection is that it is not cold storage that makes the eggs of inferior quality (when they are so), but that they were not good when they went in. It is not compulsory branding that is so necessary as strict supervision over all eggs put into cold storage.

The effect of branding would be to prejudice the public against these eggs, and consequently to depreciate their value on sale. If the poultry-farmer is willing to have this result while the public are being educated up to the true value of cold-store eggs, then he may join the advocates of branding.

Reminders for the Month.

It is a matter of observation that most of the chicken troubles appear early in September, when the weather commences to warm up. On many farms where fair success has attended rearing up to that time, chickens begin to look peaky and miserable, and many deaths occur. The tendency in such cases is to attribute the trouble to disease, whereas experience shows that 90 per cent. of such troubles are due to causes that are preventable. One of the most prolific sources of trouble at this point in the rearing season is the notion that as the weather is getting warmer the chickens require less artificial heat. A moment's consideration should dispel this fallacy. If artificial heat is applied at all it stands to reason that the same temperature is required at all seasons of the year; and, in fact, rather than a lower temperature it would be more reasonable to maintain a slightly increased

temperature in warmer weather. The reason for this is that the chickens will feel the lower temperatures that occur in the spring at night and morning more severely than when the days are cooler.

Many cases have come under notice where this lowering of temperatures has been responsible for great loss through the chickens packing at night. The effects of these troubles are so insidious—often taking days to show up—that the operator invariably fails to connect up the true cause in such a manner as to trace the commencement back to a cold night or nights, or to occasions when temperatures in the brooders have fallen below those set out as necessary for the different ages. It is sound practice to maintain the correct temperatures recommended by the Department.

Another cause of failure to rear chickens successfully is the temperature in the brooder falling towards morning—very often without the knowledge of the operator. If trouble is being experienced, or if the chickens are looking in any way dejected, the attendant will do well to turn out of bed somewhat earlier than usual, either before or about daybreak, to see what is happening with the brooders. Sometimes a surprise awaits him. Certainly it should be done occasionally if not regularly. The practice of letting matters take their course in the comfortable expectation that everything is all right is responsible for no end of failures in rearing.

For the benefit of new readers and of those who are not in possession of other leaflets on the subject, the temperatures necessary for good rearing under warm brooding conditions might be re-stated:

TEMPERATURE TABLE.

Age of Chickens.	Temperature. (Bulb of Thermometer 2 inches from floor.)
First Week	90 degrees Fahrenheit.
Second and Third Weeks	86 to 82 degrees ,,
Fourth and Fifth ,, ...	82 to 76 ,, ,,
Sixth Week	Wean them off heat.

The temperatures shown are the minima of safety in an ordinary brooder.

COMMUNITY SETTLEMENT.

ATTENTION is drawn to the facilities now available for increasing the population of country districts by the introduction of families and boys who can be drafted from any particular part of the United Kingdom. All the churches, clubs, progress associations, and other organisations are being invited to link up with the New Settlers' League, which has branches throughout the State, and after ascertaining the prospective openings in their own district, effect a nomination of as many persons as can be absorbed. It is felt that by securing all these from the one district in Great Britain, the feeling of loneliness will be overcome, and with contentment better service can be looked for. Full particulars may be obtained from the Director of Immigration, 78 Elizabeth-street, Sydney.

"TEXT-BOOK OF POMOLOGY."

THIS is one of the Macmillan Company's "Rural Text-book Series," a series that has included some excellent productions, and in which the present finds a useful place. The purpose of the book, as the preface tells us, "is to present the experimental and investigational bases of fruit-growing on the physiological side." It collects into convenient form, particularly suitable for students, much of the experimental matter that has been accumulated by many workers on fruit and related subjects. The selection of the material seems to have been well made, and the student can now draw his own conclusions as to the practice of fruit-growing from this comprehensive survey of most of the experiments that have been conducted in connection with pruning, thinning of fruit, orchard soils, cultural methods, fertilisers, relation of climate to fruit production, pollination and sterility, improvement of fruit, propagation, the storage of fruit, and a good many other cognate subjects. A number of tables, full-page illustrations, and smaller drawings accompany the matter.

A very large number of authorities have been laid under contribution—so many that the author in his preface remarks that the careful work of recent years has made use of nearly all the sciences in attempting the solution of problems—and a book has been compiled that will be useful for many and greatly varied conditions.

Our copy from the publishers, Macmillan & Co., Ltd., New York.

PRUNES AND PLUMS ON VARIOUS STOCKS.

EXPERIMENTS were carried out during the season 1922–23 at Yanco Experiment Farm with prunes and plums on various stocks. In the following table are shown the results as affecting growth and crop:—

Stock.	Variety.	Growth.	Crop (1923)
Myrobolan ...	Angelina Burdett	Good ...	Good.
Marianna ...	" " ...	Weak ...	Very good.
Apricot ...	" " ...	Strong to very strong	Fair.
Peach ...	" " ...	Very strong ...	Good.
Myrobolan ...	Clairac Mammoth ...	Good ...	Good.
Marianna ...	" " ...	" ...	"
Apricot ...	" " ...	" ...	Fair.
Peach ...	" "	Fair to good ...	Light.
Myrobolan ...	President Plum ...	Poor ...	Good.
Marianna ...	" " ...	Fair ...	"
Apricot ...	" " ...	Good ...	"
Peach ...	" " ...	Very good ...	"
Myrobolan ...	Robe de Sergeant ...	Fair ...	Fair.
Marianna ...	" " ...	Good ...	"
Apricot ...	" " ...	" ...	"
Peach ...	" " ...	" ...	"
Myrobolan ...	Prune d'Agen ...	Good ...	Good.
Marianna ...	" ...	" ...	Very good.
Apricot ...	" ...	" ...	Light.
Peach ...	" ...	" ...	Very good.

Establishment of an Out-apiary.

W. A. GOODACRE, Senior Apicultural Instructor.

In the building up of an out-apiary, or, in fact, any apiary wherever situated, it is always to the bee-farmer's best interests to study the breeding of bees, and to raise queens from selected stock of pure Italian strain. In its literature, and in the starting of the Queen Bee Competition, the Department has endeavoured to stimulate this desire for improved breeding in bees. With regard to selection in breeding bees, the experience of the Department in the establishment of an out-apiary should be of interest, since remarkably good results were obtained.

Having decided on a particular site for an out-apiary—3 miles distant from any established farm, and with a permanent water supply available—the site was fenced, a honey-room built, and stands for the hives set down. The next procedure was to find and remove all bees from bee-trees in the neighbourhood during the early spring. To find the bee-trees, we had first of all to make a systematic search of all watercourses and supplies, and any bees found obtaining water were carefully sight-lined and their home found.

During October we were in a position to place select stock on the prepared site with the prospect of raising queens with little risk of interference in the breeding from an outside source. To start the out-apiary, five of our best colonies, selected from 150 hives, were transported to the new site. To make sure that a good supply of drone bees would be provided for future mating purposes, previous to transportation each of the select colonies was given a fair supply of drone comb, placed in a position convenient for the queen in the brood chamber. From the best colony of the five selected ones we raised twenty-four queen cells. Ten days after the larvæ were grafted the cells were ripe enough for removal, and twenty-four nuclei colonies were formed at our other apiaries and transported to the new site, where a queen cell was given to each one. In the forming of the nuclei colonies special care was taken to see that no drones were put in. After the queen cells were put in the hives the young colonies were not interfered with for fourteen days, when all except three were found to have laying queens. The three queenless ones were assisted by placing a frame of brood in each, and giving another queen cell which had been raised for such emergency. The season being a good one (the promising prospects previously observed on the flora having continued), the young colonies were progressive, and quickly built up to a populous condition. By following the procedure mentioned we had fifty-three colonies going strong during January, and were enabled to extract a good surplus of honey from them. Remarkably good results were obtained in the quality of the breeding, all queens were purely mated, and upon appearances it is safe to say were from the drone

progeny of the five select queens with which the apiary was commenced. The returns from this apiary were always of a very high standard, and, apart from the financial aspect, the manipulation of such colonies was easier and of more interest than is usually the case.

Apart from the advantage gained in the one particular apiary, the bee-farmer can raise queens to re-queen stocks at other apiaries. In the extension of operations a few of the select stock from such a farm can be removed to provide special breeding on a new site.

Abbreviations of Names of Apples and Pears.

At the tenth annual meeting of the Pomological Committee of Australia held recently in Melbourne there were recommended for consideration the following abbreviations to be used in branding cases of apples and pears for export to overseas or interstate markets:—

Apples.

Name.	Abbreviation.	Name.	Abbreviation.	Name.	Abbreviation.
Adam's Pearmain	A P m	Fanny ..	F n y	Rome Beauty ...	R B y
Alfriston	A l f	Foster	F o s	Rymer	Rymer
Allington	A l n	French Crab ...	F C b	Spitzenberg ..	S p t z
Alexander . ..	A l x	Granny Smith ...	G r S	Scarlet Pearmain ..	S P m
Aromatic	A r o	Gravenstein ...	G r a v	Sturmer Pippin ..	St P
Bismarck . .	B m k	Hoover	H v r	Scarlet Nonpareil ...	S N p
Ben Davis	B D s	Jonathan	J o n	Senator	S e n
Buncombe .	B c m	King David ..	K D v	Stone Pippin ...	Stone P
Commerce .	C o m	King of Pippins ...	K / P	Strawberry Pippin (Winter Strawberry.)	Str Pn
Crow's Egg	C E g	Lord Suffield .	L S d	Statesman	S t m n
Cleopatra . ..	C l e o	London Pippin ...	L P n	Stayman (Stayman Winesap).	Sty W
Cox's Orange Pippin	C.O.P.	Lord Wolseley ..	L W y	Tasman's Pride ...	Tas P
Crofton	C f n	McIntosh Red .	McI R	Tasma	Tasma
Delicious .	D e l	Mobb's Codlin ...	Mob C	Worcester Pearmain	W P m
Dougherty ...	D h t y	Nickajack	N j k	Yates	Yates
Duke of Clarence .	D / C	Newtown Pippin ...	N P n		
Dunn's ...	Dunns	Perfection .. .	P f n		
Dumelow (Wellington Pippin) ..	D m l	Prince Alfred ...	P A d		
Fameuse (Lady in Snow, Pomme de Niege) .	F a m	Ranelagh	R a n		
		Rienette de Canada	R / C		
		Ribston Pippin ...	R P n		
		Rokewood .	R k d		

Pears.

Beurre Bosc ..	B Bosc	Clapp's Favourite...	Clp F	Keiffer	K f r
Beurre Clairgeau .	B C g u	Conference... ...	Conf	Madame Cole ...	M Cole
Beurre d'Anjou ..	B / A	Doyenne du Comice	D / C	Marie Louise .	M L
Beurre de Capiaumont	B / Cap	Duchesse d'Angouleme	D / A	Packham's Triumph	Pk T
Beurre Diel ..	B Diel	Gansel's Bergamot	Gan B	Vicar of Winkfield (Napoleon). ...	V / W
Beurre Easter .	B East	Giblin	G b n	Williams	W B C
Beurre Hardy ..	B Hdy	Glou Morceau ...	G l M	Winter Cole ...	W Cole
Beurre Superfine ..	B S f n	Howell	H w l	Winter Nelis ...	W Nelis
Black Achan ...	B Ach	Josephine de Malines	Jos / M		
Broompark ...	B P k				

With short names, such as Fanny, Rymer, Dunn's, Tasma, Yates, Howell, and others, it is optional to use either the abbreviations or the full names.

Initial letter or letters to be in capitals, other letters to be small.

The stroke sign / denotes "of" or "de."

Apples to be branded in black; pears in red, or in white if jarrah cases are used.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Growers who have crops suitable for seed purposes are invited to communicate with the Department of Agriculture, Sydney. This should be done in ample time to allow of an inspection of the crop to be made before harvesting.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Maize (varieties in order of maturity):—

Wellingrove	Manager, Experiment Farm, Glen Innes.
Iowa Silvermine	J. Morphett, Farm 863, Stanbridge, *via* Leeton.
	P. A. R. Gersbach, Farm 864, Leeton.
Funk's Yellow Dent	T. C. Weedon, Beverley, South Gundagai.
	J. R. Knapp, Bolong, *via* Nowra.
	L. B. Garrad, Milton.
	A. E. Brown, Mt. Keira.
Craig Mitchell	K. W. D. Humphries, Muswellbrook.
Coodra Vale	R. S. Lindeman, Coodra Station, Wee Jasper, *via* Yass.
Hickory King	J. W. Henry, Bolong, *via* Nowra.
Leaming	E. W. Alway, Jones Island, Manning River.
Manning Silvermine	W. J. Adams, Dumaresq Island, Manning River.
Golden Beauty	R. Richardson, Tinonee, Manning River.
	A. M. Hooke, Kootingal, Taree.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy	F. Waters, East Kempsey.
	G. P. Collins, Fairy Hill, Casino.
	J. P. Mooney, Taree.

Grain Sorghum:—

Feterita	Manager, Experiment Farm, Coonamble.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Dwarf Kafir	P. A. R. Gersbach, Leeton.
White Yolo	P. A. R. Gersbach, Leeton.

Sweet Sorghum:—

Early Amber Cane	Manager, Experiment Farm, Bathurst.
Selection No. 61	Manager, Experiment Farm, Grafton.
Selection No. 34	Manager, Experiment Farm, Yanco.

Potatoes:—

Satisfaction	H. F. White, Bald Blair, Guyra.
	G. H. J. Price, Yarrowyck-road, Armidale.
Late Manhattan	K. Bowen, "Newport," P.O., Orange.
Langworthy	K. Bowen, "Newport," P.O., Orange.
Symington	H. F. White, Bald Blair, Guyra.

Millet:—

Japanese	Manager, Experiment Farm, Coonamble.
Broom	Manager, Experiment Farm, Coonamble.

Lucerne:—

	*W. E. Myring & Sons, "Nungaroi," Pallamallawa.
	A. L. Thomas, "Merrivale," Bedgerebong, *via* Forbes.

Shearman's Clover (Roots):—

	J. H. Shearman, Fullerton Cove, *via* Newcastle.

Peanuts:—	
Valencia...	... S. Broom, Farm 1298, Griffith.
Chinese	... S. Broom, Farm 1298, Griffith.
White Spanish	... S. Broom, Farm 1298, Griffith.
Grasses:—	
Elephant Grass (Roots) ..	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Yanco.
	Principal, H. A. College, Richmond.
Kikuyu Grass (Roots)	Principal H. A. College, Richmond.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm Glen Innes.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

Viticultural Notes for September.

Owing to the wet winter conditions experienced in some parts of the State, and particularly on the irrigation areas, it is as well to bring before growers the advisability of swabbing the varieties that are susceptible to black spot, and at the same time of overhauling their spraying machinery, so that everything shall be in readiness for spraying later. If, during the spring, we should experience anything like wet conditions, downy mildew is bound to make its appearance, and no grower should run the risk of losing his crop during the flowering or setting periods. The fact of last season being extremely dry, with practically no indication of downy mildew, may tend to make some growers lax in regard to early spraying, but they should realise that this winter has been anything but dry as compared with last season, and in consequence no risks should be taken.—H. L. Manuel, Viticultural Expert.

Identification of Cows by Nose Prints.

Finger-print identification of criminals and suspects has been in use for more than twenty years, but it has taken a long time for anyone to think of applying the principle to the identification of dairy cows. According to the *Scientific American,* the idea is now being worked out by the Division of Dairy Husbandry at the University of Wisconsin.

The cow's nose is traversed by innumerable ridges similar to those of the human hand, and from the patterns of these it is possible positively to identify each animal. The prints of more than 350 animals have been taken and carefully scrutinised, and so far no two have been found sufficiently alike to allow of even uncertainty as to their being from different animals. Growing calves and older animals have been nose-printed for at least five consecutive months without any change of design being detected. There may be, and is, enlargement of the nose, but the arrangement of the ridges remains fixed.

The print is taken by rubbing the nose dry with a flannel cloth, then rubbing a common rubber stamp pad across the nose until the ridges are well marked, and finally firmly pressing a sheet of soft paper, fastened to a board, against the nose, beginning with the lower edge of the paper at the base of the upper lip, and rolling upward toward the face.

It may be some time before the system is applied here, but it has already proved useful in several cases in the United States, and seems likely to be of special value in connection with live-stock insurance.

Orchard Notes.

SEPTEMBER.

W. J. ALLEN and W. LE GAY BRERETON.

ORCHARDS that have been ploughed in the winter and left in a rough state can generally be worked up at this period by means of a cultivator, but where the practice of ploughing early in the autumn is followed and no winter ploughing has been carried out a ploughing is often necessary at this time to put the land in the right condition for the summer cultivation. Where possible it is preferable to delay this second ploughing until the bulk of the spring spraying and consequent trampling is through. In order to conserve the moisture in the soil for the use of the trees during the growing period, it will be necessary to keep the soil loose and free from weeds, not forgetting the soil close round the butts of deciduous trees and a much wider area round citrus trees, which cannot be worked with horse implements and which must be dealt with by means of forked or flat hoes.

Pests and Diseases.

Apple and pear growers probably need no reminder of the trouble that codlin moth caused them last season. It is possible that last spring a greater percentage than usual of the carry-over grubs from the previous season "hung fire," and did not commence to emerge as moths till late in the season—hence the grubs were not killed by the early sprays. Be this as it may, the point that should be kept prominently in mind by apple and pear growers is that the carry-over grub from one season is the sole source of all the trouble in the next, and no means of destroying as many as possible of these grubs should be neglected.

Any cases or receptacles that held moth-infested fruit last season should be dipped in boiling water, and where possible packing sheds should be made moth-proof. It is a great pity that all sheds are not moth-proof, so that when the grubs start to emerge they can be killed on the window as they fly to the daylight.

The butts and lower parts of the main limbs of the trees should be examined, and any grubs harbouring in crevices or loose bark destroyed. A favourite place for hiding is about the crown of the tree, against the rolls of bark that form where the thick main limbs join one another. Where bandages have been left on during the winter, they should also be examined and any harbouring grubs destroyed. The above work should be carried out before the earliest moths start to emerge from the chrysalis stage.

For the deciduous fruitgrower—especially the apple, pear, and grape grower—the spring means a busy time with the spray pump, and no time should be lost in seeing that the outfit is in thorough working order, and that supplies of spray material are to hand.

In districts where black spot is likely to attack apples and pears, the trees should be sprayed as a precaution against that disease at from the "spur-bursting" stage to pinking stage, with either lime-sulphur at spur-bursting strength or Bordeaux mixture, 6-4-40. As has been stated before in these Notes, the latter has proved in some instances to be a superior fungicide to the former, but is liable to cause a russetting of the fruit. The fruit is most susceptible to this damage from the pinking stage till four or five weeks after setting. If Bordeaux mixture is applied at an early spur-bursting stage, when a large percentage of the blossom buds have only the tips of the sepals showing, russetting will only occur on the few more advanced clusters of blossom buds, and hence the damage will only be slight. Later spraying can then be carried out with lime-sulphur up to a month or five weeks after setting; then, as the damage from the russetting is generally not so severe after that stage, Bordeaux mixture 6-4-50 can be used if the weather is favourable for a late development of "spot." There is evidence that if the trees have not received an application of lime-sulphur before the fruit-setting period, applications of lime-sulphur even at summer strength are liable to cause dropping of fruit and some defoliation. So that where Bordeaux is used for the first spray and it is proposed to follow with lime-sulphur, the first application of lime-sulphur should be made during the pinking stage.

Experiments have shown that Bordeaux mixture is the better fungicide to use for black spot of Williams pears in our coastal districts, lime-sulphur not only giving less control, but being also liable to cause defoliation.

Trevitt apple is also very liable to injury from sulphur sprays. Regular applications of these initial sprays are advocated to afford protection during the blossoming period, and they should be followed up by later applications if the weather continues favourable for "spot," but it is advisable not to make the later applications if the weather turns dry and there is no development of spot—not only for reasons of economy, but because these fungicides have a more or less depressing effect on the trees when applied frequently during a season.

The first application of fungicide should be made for powdery mildew of the apple at spur-bursting to pinking, and should then be combined with each lead arsenate spray. Atomic, atomised, and colloidal sulphur have proved equally effective in controlling this disease when applied at the times mentioned, and provided care is taken to remove mildew-affected parts at the time of pruning. Colloidal sulphur is prepared by precipitating sulphur from lime-sulphur with sulphuric acid and is cheaper to use than atomised or atomic sulphur.

Leaflets on the making of colloidal sulphur and on the control of black spot and mildew of the apple can be obtained on application to the Under Secretary and Director, Department of Agriculture, Sydney.

Though in the orchard at Glen Innes Experiment Farm lime-sulphur does not give a control over apple mildew, it is quite effective at Bathurst Experiment Farm, and it is possible it will be so in some other districts. Where this is the case, the one spray is useful for control of both black

spot and mildew, but where it does not apply either atomic, atomised, or colloidal sulphur can be combined with lime-sulphur. In fact, with care an excess of lime-sulphur could be allowed when diluting the lime-sulphur, and the right quantity of sulphuric acid could be added to precipitate this excess.

For black spot and downy mildew of the grape vine, Bordeaux mixture is the most effective spray, lime-sulphur not being efficient against these diseases. Leaflets with instructions for the control of these diseases, also of oidium (powdery mildew), can be obtained from the Department of Agriculture, Sydney.

Should woolly aphis be showing on the apple trees, tobacco wash or a commercial tobacco extract, provided they contain no foreign material liable to upset the other spray, can be combined with the fungicides mentioned above. Care must be taken to maintain the right proportion of each spray to the total bulk of liquid.

In the coastal districts apples and pears often blossom over a long period, and some varieties will be ready for the first lead arsenate spray during this month, but the majority of varieties in the tableland and inland districts will not be ready till next month.

Should aphis show on peach, nectarine, or Japanese plum trees, spray immediately with either tobacco wash or one of the commercial nicotine extracts. Use a high pressure and hold the nozzle close to all affected parts to break up the clusters of the insects, and if within two or three days any live aphis are left repeat the application at once.

Fruit Cases in the United States.

The following extract was taken from a Bulletin published by the United States Department of Agriculture entitled "Standard containers for Fruit and Vegetables":—

"There are two orange boxes in common use—the Californian box, which holds approximately 1·47 bushels, and the Florida box, which contains 1·6 bushels. Both boxes are well established by custom, and the difference in capacity is recognised everywhere by the trade. . . . . The orange box is used for grape-fruit as well."

The reference to the bushel above would be to the Winchester bushel 2,150·112 cubic inches, the standard bushel of the United States The Imperial bushel contains 2,218·192 cubic inches.

The dimensions given are:—

California orange box	11½ x 11½ x 24=3,174	cubic inches.
Florida orange box	12 x 12 x 24=3,456	,,
,, Tangerine box	6 x 12 x 24=1,728	,,
California lemon box	10 x 13 x 25=3,250	,,

The cubic capacity given above does not allow for the division in the centre with which these cases are generally provided.

Cases of these sizes are not permitted by our Case Act for State or Interstate trade, but the information may be of interest to exporters of citrus fruit beyond the Commonwealth.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
Cowra P.A. and H. Association	E. P. Todhunter	Sept. 11, 12
Cootamundra A. P. H. and I. Association	W. W. Brunton	,, 11, 12
Narandera P. and A. Association	W. H. Canton	,, 11, 12
Gunnedah P. A. and H. Association	M. C. Tweedie	,, 11, 12, 13
Barmedman A. and H. Society	A. J. Meagher	,, 12
Murrumburrah P. A. and I Association	W. Worner	,, 13, 14
Holbrook P. A. and H. Society	J. S. Stewart	,, 18, 19
Ganmain A. and P. Association	A. R. Lhuede	,, 18, 19
Canowindra P. A. and H. Association	J. T. Rule	,, 18, 19
Temora P A. H. and I. Association	A D. Ness	,, 18, 19, 20
Boorowa P. A. and H. Association	W. Burns	,, 20, 21
Northern A Association (Singleton)	J T. McMahon	,, 20, 21, 22
Henty P. and A. Society	H. Wehrman	,, 25, 26
West Wyalong P. A. H. and I. Association	T. A. Smith	,, 25, 26, 27
Hay P. and A. Association	C. L. Lincolne	,, 26, 27
Koorawatha A. Society	J. A. Larson	Oct. 2
Ardlethan A. Society	R. Neill	,, 3
Walbundrie P. A and H. Society	W. Goldsworthy	,, 3
Berrigan A. and H. Society	R. Wardrop	,, 9
Ariah Park A. Society	J. F. McInnes	,, 10
Deniliquin P. and A. Society	P. Fagan	,, 17
Griffith A. Society	M. E. Sellin	,, 17, 18
Gundagai P. and A. Society	J. Gardiner	Nov. 14, 15
Adamstown Agricultural Bureau	G. Brock	,, 16, 17
Lismore A. and I. Society	H Pritchard	,, 20, 21, 22
Tweed River A Society	T. M. Kennedy	,, 28, 29

1924.

Society.	Secretary.	Date.
Albion Park A. and H. Association	H. R. Hobart	Jan. 11, 12
Dapto A. and H. Society	E. G. Coghlan	,, 18, 19
Wollongong A. H. and I Association	W. J. Cochrane	,, 31 to Feb. 2
Guyra P. A. and H Association	P. N. Stevenson	Feb. 19, 20, 21
Nepean District A. H and I. Society	C. H. Fulton	,, 21, 22, 23
Moruya A. and P. Society	H. P. Jeffery	,, 27, 28
Newcastle A H. and I. Association	E. J. Dann	,, 26 to Mar. 1
Manning River A. and H Association (Taree)	R. Plummer	Mar. 4, 5, 6
Yass P. and A. Association	E. A. Hickey	,, 5, 7
Berrima A. H. and I. Society	W. Holt	,, 6, 7, 8
Central New England P. & A. Assoc (Glen Innes)	Geo A Priest	,, 11, 12, 13
Mudgee A. P. H. and I Association	J. H. Shaw	,, 11, 12, 13
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 12, 13
Hunter River A. and H. Society (West Maitland)	J. S. Hoskins	,, 12 to 15
Crookwell A. P. and H. Society	C. H. Levy	,, 20, 21
Rydal A. H and P. Society	S. Bruce	,, 23
Tamworth P. and A. Association	F. G. Callaghan	,, 25, 26, 27
Narrabri P. A. and H. Association	E. J. Kimmorley	,, 26, 27
Campbelltown A. Society	J. T. Deane	,, 28, 29
Blacktown A. Society	J. McMurtrie	April 4, 5
Orange A. and P. Association	Geo L. Williams	,, 8, 9, 10
Upper Hunter P and A. Association (Muswellbrook)	R. C. Sawkins	,, 9, 10, 11
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 14 to 23
Clarence P. and A Society	L. C. Lawson	May 7, 8, 9, 10

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VOL XXXIV. PART 10. OCTOBER 1, 1923.

Agricultural Gazette of New South Wales.

Irrigation Farming in New South Wales.

CHOOSING AND EQUIPPING A BLOCK.

A. N. SHEPHERD, Senior Agricultural Instructor.

THERE are many localities in New South Wales where water is available in sufficient quantities to admit of considerable areas of excellent land being brought under more profitable occupation than for grazing or ordinary farming methods.

The magnitude of the impounding works at Burrenjuck, and the wide expanse of cultivable land commanded by the waters stored there, have served to emphasise the possibilities of many of our rivers, and to direct attention to the various schemes for the use of the waters of the Murray, Lachlan, Macquarie, Hunter, Warragamba, and other rivers. But even these by no means exhaust the opportunities for development of the resources of the State in this direction. On the banks of every one of these rivers there are rich, deep, alluvial soils that could be devoted to intensive production by the application of water. Already many pumping plants are in existence and crops are being raised with the aid of river water. The possibilities of development in this direction, however, have barely been touched. Nor are they limited to our inland rivers. A few coastal farmers are proving each season the immense value of our coastal streams for the maintenance of supplies of feed, and are lifting water on to selected paddocks devoted to the growth of fodder crops for the dairy cattle and pigs. That the number of such plants must increase within the next few years needs no speculation.

It may be assumed, therefore, that though the resources in the way of irrigation are not so great as, for instance, in the United States (where already the area under irrigation equals or exceeds the total area cultivated in Australia), we are only upon the doorstep of the development of our water resources. The following pages have been written with this fact in mind.

It is somewhat inevitable that the subject should be approached from the point of view of the necessities of the farmer who is already, or who hopes to be, located on the Murrumbidgee Irrigation Areas, but it has also been a secondary object in the compilation of this matter that the requirements of farmers in other parts of the State, who wish to adapt a portion of their farms to irrigation, should find here what will be of use to them.

Irrigation farming is in its infancy in New South Wales, and new settlers have not, therefore, the advantage of the experience of many successful

men to follow as they have in most other primary industries, but the results of the past few years on the Murrumbidgee have sufficiently indicated lines on which operations may be conducted with good prospects of success.

Choosing an Irrigation Farm.

Thanks to the methods of the Water Conservation and Irrigation Commission, the settler's task in opening up a block is fairly simple. A series of farms in a locality is offered at one time, contour maps showing the high and low portions of each area and how watering can best be done being supplied for each block, and every assistance and advice being offered for the lay-out of the farm and the distribution of the water. The settler has, therefore, only to consider the relative merits of each block and to decide for which one he will be an applicant. The difference between one and another may be very slight, and the settler will be guided largely by the crop for which he intends to use the land, and by other personal preferences.

The soils on the Murrumbidgee Irrigation Areas vary greatly—light sandy soils, loams, clay loams, heavy red clays, grey soils and boree country all occurring. These require very different manipulation, and the classes of crops that do best on the different soils have also to be taken into account. For the sandy soils, for instance, lucerne, cotton and root crops like potatoes, mangels, and turnips are specially adapted, while the boree country, taking the water very unevenly in the summer—and, therefore, giving uneven crops—will produce good winter crops after a summer fallow. Hence the class of production that the farmer has before him is necessarily a factor in the choice of a block.

The proximity of a main road, and the manner in which the selection lends itself to convenient lay-out must be considered, and also the ease with which water may be conserved. Preconceived notions to the contrary notwithstanding, water must be conserved on the irrigation farm so that the stock may not have to go short in the winter Settlers endeavour to place the dams so as to serve three or four paddocks, and fill them from the channel in the latter part of the autumn.

The channels for the distribution of water over the farm largely govern the lay-out of the property, but there are considerations that must not be overlooked. If it is proposed to devote attention chiefly to dairying, it is important to select the farm with hand-feeding well in view. Sooner or later that method of handling cattle is going to be adopted more extensively on many farms, and lay-out is of much importance in relation to it. The highest part of the farm will be most suitable for the buildings, but it is important that these should also be near a main road, if possible, so that the carting of cream, &c., may be reduced to a minimum. The relation of the yard and stalls to the buildings must also be considered, and the cropping paddocks must be at hand, so that the feed can be brought in with as little haulage as possible. The paddocks should be arranged so that the heavier

crops, like maize and sorghum, may be grown near to the homestead, while the grazing paddocks may be a little further away, for on an irrigation farm the distances are so short that the driving of the cows to and from the milking shed is insignificant.

The drainage of surplus water from the farm is an important factor, and to it the intending irrigation farmer must direct some attention. Large areas of country now settled upon and used for irrigation have no natural sub-drainage, and this necessitates the construction of surface drains to carry off excess water. On large settlements like the Murrumbidgee Irrigation Areas, these drains are constructed simultaneously with the supply channels, and the network of drainage canals is almost as extensive as that of the supply channels. n selecting a farm, it is a consideration that should receive some attention that there should be in close proximity a large drainage ditch, as no trouble will then be experienced in keeping the farm free from water-logged patches.

Where irrigation is contemplated in some other portion of the State, the factors chiefly to be taken into account are that the supply of water shall be reasonably assured, that the climate is favourable, and that the soil is suitable for the class of crop to be grown. As to the first, every inquiry should be made, and as to the second, it is obvious that it is no use attempting certain crops in cool districts or sinking much money in plant and lay-out where the summer season is short. As to the third factor, lucerne may be mentioned as preferring deep alluvial soils, while melons, and perhaps tobacco, to mention no others, are adapted to light, sandy loams.

Methods of Irrigation Practised.

The methods of irrigation that are adopted on the Murrumbidgee Irrigation Areas are (1) flooding, (2) furrow irrigation, (3) overhead spraying, (4) the wave system.

By *flooding* is meant allowing the water to flow over a whole area, and controlling it by a series of check banks. The nature of the soil will regulate the rate and amount of water to be applied; with sandy soils quick watering is desirable (though scouring must be avoided), while with heavier types of land, slow irrigation should be given to encourage penetration of the water to as great a depth as possible.

For this system the land is prepared by grading and then dividing it off with check banks high enough to keep the water within defined areas. These check banks are usually made ½ to 1½ chains apart, according to the nature of the soil and the fall of the land. The length of the "checks" or lands also depends on the soil; with a light sandy loam the lands must be much shorter than with heavy soils. The height of the check banks varies somewhat with the nature of the crop; for a permanent crop like lucerne they should be made a little higher and wider than for, say, wheat; in the latter case they should only be just high enough to hold the water in check and not high enough to interfere with harvesting machinery.

Furrow irrigation consists of running a series of furrows between the rows of the crop, and sending the water down these furrows. The system is adopted in connection with such crops as maize, cotton, potatoes, &c., which are grown in rows, and it is the method almost universally in vogue in irrigating orchards. The crop is sown in the rows, and, being up, an implement with broad tines or shovels is run between the rows to form furrows 3 to 4 inches deep, according to the nature of the soil. The ordinary one-horse scuffler or two-horse cultivator, or an ordinary light single-furrow plough are all suitable for making the furrows. Some farmers are adopting the method of fixing to the two-horse cultivator a piece of 3 x 4 timber, up to 9 feet long, to which have been attached three or four ordinary standards of the cultivator with the broad shovels, and in this way they make three or four furrows at one stroke, an acre being prepared for irrigation in a very short time.

Where furrow irrigation is practised for crops cultivated in close rows, it is an advantage to connect all the furrows at their upper ends by running a large furrow parallel with the ditch, into which the sluices, temporary or permanent, discharge. The water can then be regulated by blocking the furrow here and there so as to discharge the requisite quantity of water into each longitudinal furrow.

The *wave system* consists of a series of close and low checks. These are usually formed with a disc implement, the discs of which are so set as to draw the soil towards the centre, a slight ridge being formed by each stroke of the implement. The highest point of each ridge is only 2 inches above the lowest point of the corresponding depression, and the ridges are only 6 to 8 feet apart at most. The system is chiefly employed on light soils on which it is desirable that the water should be applied quickly. Seepage from one depression toward another—laterally is good under such conditions, and the whole area can be wetted in a minimum of time. The ridges must not be high or trouble will be experienced in watering the crop and also in harvesting it.

Of *spray systems* of irrigation there are several, the object in all cases being to apply the water as nearly as possible to the natural method of rainfall. The great difficulty is that a head or pressure of water is essential, and to obtain that storage tanks or engine pumps are necessary. The method is chiefly applicable to vegetable growing.

Watering by lateral seepage is also practised, usually by vegetable growers on the lighter types of soil. The beds are laid out about 2 feet wide between ditches about 12 inches deep. The ditches are filled with water, and the water is then allowed to saturate the beds by soakage or seepage.

From the above it is sufficiently clear that the method of irrigation to be adopted depends very largely on the class of crop to be grown. On a mixed farm it is probable that two or even three of these systems may be found in operation

The Construction of the Main Ditches.

Having thus stated some of the considerations that must receive attention in the choice and lay-out of an irrigation farm, and indicated the most common methods of applying the water, we may proceed to discuss the construction of the ditches or main channels by which the water is to be distributed over the property. These will follow the highest lines of the irrigable land of the farm, so that they shall command as great an area as possible. If care be taken in the lay-out of the ditches, the same channels can be utilised for drainage and supply to a lower plot. That is, the water can be drained off the higher plot into a ditch which is connected with the supply to the next area. This applies chiefly to land with a fair fall.

If the farmer is not on the Murrumbidgee Irrigation Areas but is undertaking irrigation in some other part of the State, it would be well, if the problem presents any difficulties, to obtain a contour plan and to work to that.

The most common method of constructing the farm ditches is to open up a strip of land with the ordinary mouldboard plough along the lines selected, and then to crowd the earth out equally to each side with a delver (See Fig. 1). Such ditches are usually V-shaped, and do not carry a great body of water.

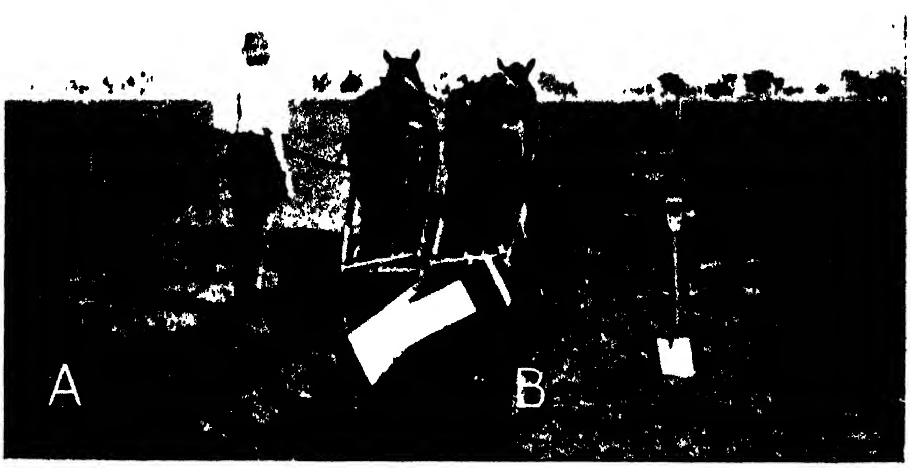

Fig. 1. Home-made delver at work making the channels; a handy implement.

If labour is available, the ditch is much improved and its water carrying capacity increased if the bottom soil is shovelled out and a round bottom made to the ditch. The banks are also considerably strengthened at the same time by the addition of the soil shovelled out.

Mr. W. J. Quodling, in a paper published in August, 1916, pointed out that "although the carrying-capacity of a channel varies with the slope, it is not the practice in the case of farm channels to depart from certain

standard dimensions to any great extent. To do so would be to introduce unnecessary refinement. It will be apparent that there is an advantage in constructing ditching to such dimensions as will admit of all the material for the banks being obtained within their own limits. Full information under this head is furnished to settlers as occasion requires."

On the lightest soils there is considerable loss of water and great damage to the physical and chemical condition of the soil by reason of the seepage or soakage of water from ordinary earth ditches. It is necessary therefore to line the ditches on such land with some impervious material, and the most convenient and satisfactory is concrete. Concrete channels are also necessary where the fall is great, owing to the liability of scouring occurring.

On land with a big fall, head ditches of concrete are usually run down the steeper fall, and in recent years a method has been devised that avoids difficulties often experienced in irrigating such faces. The method consists of constructing small wells at intervals in the bottom of the concrete ditch, and drawing the water off by pipes (preferably iron ones) laid through the concrete wall into the wells. The pipes deliver the water into furrows, the method being combined with furrow irrigation.

Checks and Sluices.

Ditch checks and regulators are necessary adjuncts to production by irrigation. They are placed where the water has to be held up and guided over the land or diverted into another direction, or where it has to be admitted from one ditch to another, and the flow regulated. For a time a farmer may make shift with temporary contrivances, such as a sheet of canvas, or a few corn-sacks sewn together and nailed to a pole, which is laid across the ditch from bank to bank, the end of the sheet being weighted with earth; but, as Mr. Quodling has pointed out, irrigating with poor equipment can become very arduous work. Permanent structures wholly of timber, or of timber and iron combined, or of concrete, soon pay for themselves in time and labour saved.

A combined regulator and check of good design in reinforced concrete can be procured ready made, and the Water Conservation and Irrigation Commission will afford settlers on the areas information as to the best positions in which to place them—in fact, it is usually given on the plans supplied to settlers.

Field sluices for regulating the water that is let out of the ditches on to the land should, if possible, be provided at any rate for orchard and vineyard irrigation. It is not always imperative to go to the expense of equipping ditches with permanent sluices for the irrigation of crops that are to be flooded, but as they enable the irrigator to control the water and greatly facilitate its application, they are desirable.

The type of sluice most in use is that illustrated in Figs. 2 and 3.

Another type of sluice consists of a plain square of concrete or ash concrete with a rectangular hole in the centre. This is let into the bank of the head ditch, and the water flows through the hole, being regulated by a tapered plug.

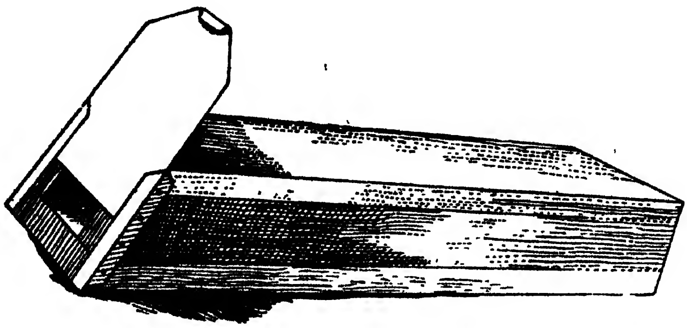

Fig. 2.—Sluice-box with regulating slide, made either in concrete or wood.

An inexpensive type of sluice that is in common use is made from length of 2-inch galvanised iron down-piping, square at one end and fitted with a sliding door attached to regulate the water. These are not so good as the more substantial sluices already referred to, but have the recommendation of being very cheap. If a horse stands on one, of course, it is of little further use.

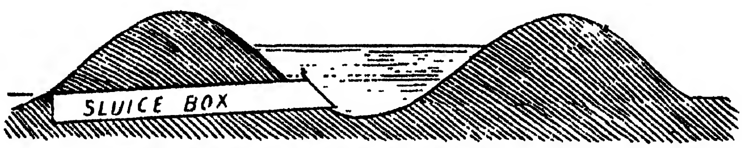

Fig. 3.—Section of head-ditch, showing sluice-box in position.

A common method of admitting water to land in the early stages of farm development is to cut a gap in the bank of the channel and to prevent scouring by pressing a handful of grass into the bottom of the cut. This direct admission to the land is, doubtless, the most convenient method, but it demands careful attention, for the water must advance very slowly over the area. No doubt this lacks the spectacular element, but experience has amply shown that anything like a rush of water wets only the surface and leaves the subsoil dry. On light sandy soils percolation of water is more rapid than on heavier soils, and the admission of water must be varied accordingly; but in any case it is bad practice to admit a big body of water at one time, for scouring generally results.

Preparing the Land.

Perhaps in no branch of agriculture is there necessity for greater care in the preparation of the land than on an irrigation farm. Whatever method of irrigation is to be adopted, it is essential that the land be thoroughly

graded and levelled or the water will lie in certain parts of the paddocks, and will miss others altogether. The result of this is that portions of the crop mature earlier than others, and while some patches burn off completely others may even be scalded by too much water. To avoid this, and to ensure that the water equally reaches all parts of the area careful grading is necessary.

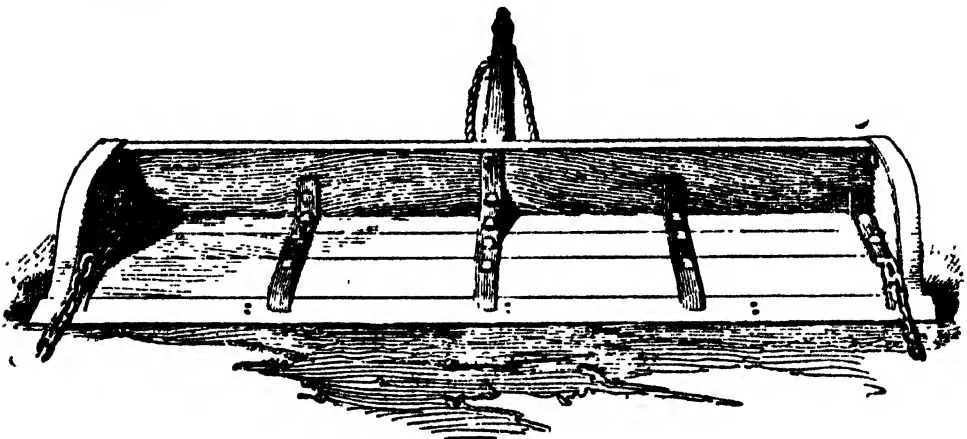

Fig. 4.—The Buckscraper -An implement that is useful to all irrigationists.

Grading.

Grading may be defined as the preparation of the land so that the water may be distributed to the greatest advantage over the whole area, and so that any excess can be drawn off without the land being damaged.

It is effected by first ploughing the land and breaking down the surface to a fairly fine condition without any large lumps, after which the grader is run over the land one way to smooth it out. Many makes of graders

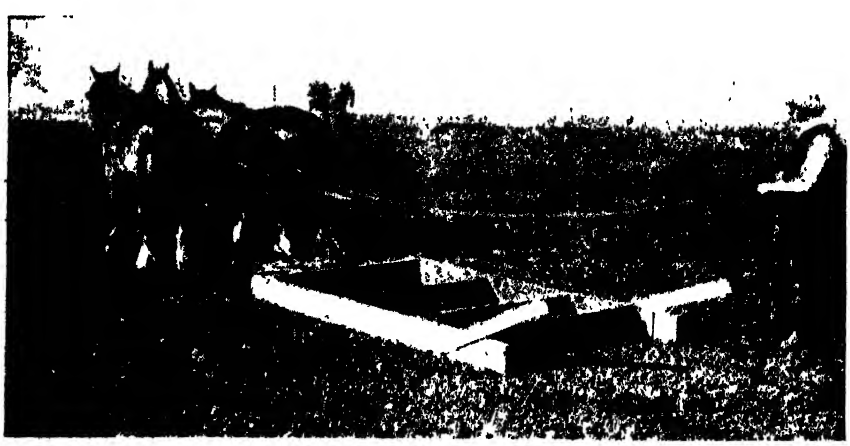

Fig. 5.– Home-made leveller at work ; an invaluable implement.

are used, but two types are illustrated (Figs. 5 and 6). If there are many "bumps" to take off or holes to fill, the buck-scraper may be employed to produce an even surface. This work of grading requires some experience, but irrigation farmers soon become practised at it, and are able to prepare their own land quite efficiently.

It is perhaps appropriate to remark that the unhindered flow of irrigation water across the field has at all times to be kept in view, and where the method of irrigation is to be flooding it is essential that all operations shall be conducted in the direction of the fall. The ploughing should be in lands and not round and round, or it will be found that dips will remain in the centre in which water will lie. Similarly, the ploughing must not be across the fall, or a great deal of grading will be necessary to produce an even surface.

Fig. 6. – Another type of louvred grader.
Useful on larger areas.

Making the Check Banks.

Where irrigation is to be by furrows, everything is ready with the completion of the head ditch and the grading. The crop is sown in its rows, or the trees planted, and the water admitted directly as stated earlier in this article.

Where, however, irrigation is to be by flooding, as with lucerne and the smaller cereals, an important operation—the making of the check banks—remains to be carried out. These banks are usually placed about half a chain to a chain and a half apart, and they may be formed in a variety of ways. A common method is to throw two furrows together with a single-furrow plough, and then with a two-way cultivator to crowd the soil against these furrows so as to form a bank.

Another method of making these banks, after throwing up the centre furrow as above, is to straddle the furrow with a crowder, illustrated in Fig. 7, and to draw it along the land so that the surface soil is forced together and falls out behind in a wide shallow bank.

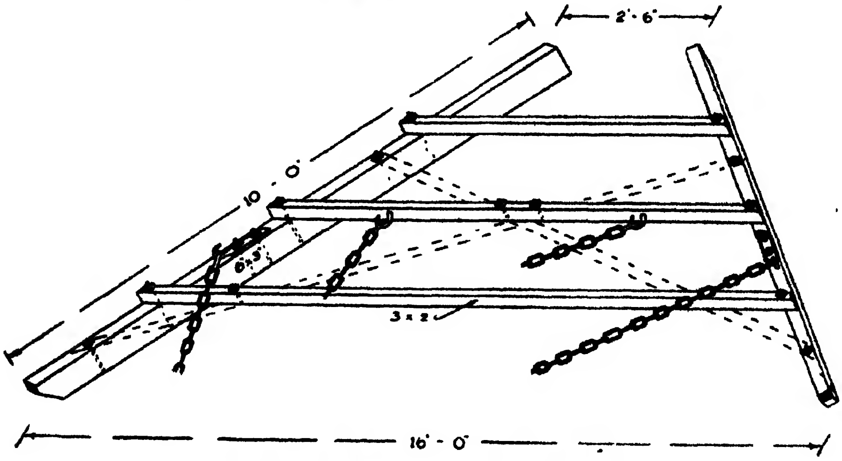

Fig 7.—A crowder that can be made at home.
Stays can be fixed along the dotted lines if desired.

Fig. 8.—Forming the Check Bank. The First Furrow.

Where operations are on a larger scale a road grader has been found a useful implement with which to force the soil into a bank. This is the method adopted on Yanco Experiment Farm, where a large area is under lucerne. The two furrows are thrown together with a single-furrow plough and the soil is then filled into the furrows with the road grader, to which a long blade, made on the farm, has been attached, to level the soil over a wide face, drawing it slightly toward the bank to strengthen it.

The ends of the checks have to be finished off by hand, as horse-drawn implements will not work right to the end of the paddock.

A very common method of making the check bank is to plough about three times round the line of each bank, reducing the depth of the plough

each time, and then to run the harrow over the whole. This is, no doubt, the handiest and cheapest way of all, but it does not give the most satisfactory results, for it is difficult to avoid leaving a furrow at the last round in which water can lie after each irrigation, to the detriment of the crop.

Fig. 9.—The Road Grader with the wide board, 10 feet long, at work at Yanco Experiment Farm.
A light cut only is taken and two trips made on each side of the bank so as to move just sufficient top soil to fill in the furrow and strengthen the check bank.

It is essential that the check banks be made broad, and not narrow, in order that implements of all kinds may pass over the field with as little injury from jolting as possible. A little consideration will suggest that both cultivating and harvesting machinery can pass over banks made like *a* in Fig. 10 without harm, while banks made like *b* in the same Fig. (10) will soon seriously damage a machine like a mower, and in time will shorten the life even of a cultivator. The one bank is as effective as the other in the control of the water, but in addition to what we have just said, it is more permanent.

Fig 10.
a **Section of a good bank.** *b* **Section of a bad bank.**

For permanent crops, such as lucerne, too much care cannot be expended on the preparation of the check banks. Properly made they will last for years, controlling the distribution of the water over the area affected, enabling the irrigator to inspect the watering dry-shod, and representing a distinct asset to the whole property.

It is essential that the lands between the check banks shall not be too long. The nature of the soil will largely determine the distance between the head ditch and the drain at the lower end, but from 6 or 7 chains to 10 chains will be found long enough under most conditions. If the block is too long the upper portion will have had ample water before the lower has received any at all.

A drain along the lower end of the paddock is quite essential, as every irrigationist well knows. Stagnant water is a thing not to be tolerated on a well-managed irrigation farm; hence, drainage must be provided as a concomitant of the head ditch, or damage will certainly occur.

(*To be continued.*)

THE VALUE OF ANIMAL MANURE.

THE value of the animal manure that is available in such quantity on coastal dairy farms and which is so often wasted was discussed in an article in the July issue of the *Agricultural Gazette* (page 519). As a means of improving the organic content of the soil and enabling the farmer to obtain the maximum results from commercial fertilisers such animal matter is of the greatest significance. At a recent meeting of the Dungog branch of the Agricultural Bureau, Mr. Alex. Smith, of Bandon Grove, submitted details of an interesting trial in this connection, and figures proving very conclusively the effect of applications of cowyard manure on soil fertility.

Last spring (1922) a quantity of cowyard manure was spread on oat stubble land, which was ploughed early in summer and left in fallow until March. Following a heavy thunderstorm, which yielded over an inch of rain, the ground was prepared for sowing to Algerian oats and Grey field peas, and on 14th March three plots were sown to this mixture—No. 1 without either fertiliser or manure, No. 2 with a commercial fertiliser at the rate of 2 cwt per acre, and No. 3 with cowyard manure in addition to the commercial fertiliser. The weights of the crops on the different plots were taken on 19th July, with the following results:—

Manurial Treatment.	Yield of Green Fodder per acre
Plot No. 1	Growth too poor to estimate.
Plot No. 2	8 tons 7 cwt.
Plot No. 3	11 tons 16 cwt.

The application of cowyard manure that had cost the owner nothing, thus gave an additional yield of almost 3½ tons of green feed per acre, or an increase of 41 per cent. Taking the value of green fodder at 25s. per ton, a profit of £4 6s. per acre was made by the use of the organic matter which so many dairy farmers apparently despise.

Conservation of Fodder.

Silage for the Dairy Farmer.

[Continued from page 616.]

A. BROOKS, Works Superintendent.

As feeding is an every-day job, it is essential that the silo shall be located close to the feeding stalls, preferably with the door opening to the end of the line of troughs, in front of which a truck may be run on rails so that the fodder can be conveyed with a minimum of time and labour from the silo to the farthest stall.

The filling of the silo and the means by which it is to be done must not be overlooked in considering the spot the silo is to occupy. The site must afford a place where the cutter and the engine can be conveniently situated. If the material is going to be delivered from the chaffcutter into the silo by means of a blower, the cutter must be placed fairly close to the silo, as the delivery pipe should be as nearly perpendicular as possible. If, on the other hand, a chain elevator is to be used, the cutter should be stood back about two-thirds of the height of the silo so that the elevator carrier may be set up at a proper angle.

In closing last month's article reference was made to the size of the silo, and it may be useful to add at this stage the following table as giving some idea of the size of silo it may be wise to build and also an indication of the quantity of silage each of several sizes may be expected to contain

Height.	Diameter.	Capacity.
25 feet.	12 feet.	55 tons.
25 ,,	14 ,,	70 ,,
25 ,,	16 ,,	85 ,,
30 ,,	14 ,,	85 ,,
30 ,,	16 ,,	102 ,,
35 ,,	16 ,,	120 ,,
35 ,,	18 ,,	160 ,,

For an average dairy herd of 35 cows the best size to build is the 30 x 14 feet, or the 25 x 16 feet both of which would provide a full ration of 40 lb. silage per cow per day for a period of five months.

Concrete or Wooden Silo—Which?

Many types of overground silos have been used, and no doubt all of them have their recommendations under certain conditions. Two types, however, most command attention in this country the concrete and the wooden or stave silo. For durability and general efficiency the concrete structure is no doubt the best, but the cost of construction is so great compared with the other, that it may be opined that the wooden silo is likely to remain with us for many years - perhaps for all time. Moreover, improvements have been

made in the wooden silo in recent years which have made it increasingly suitable for the small farm, while the facts that the plant required for the work of erecting is small and the materials comparatively cheap, and that the farmer can more easily carry out the work for himself, represent substantial recommendations in its favour.

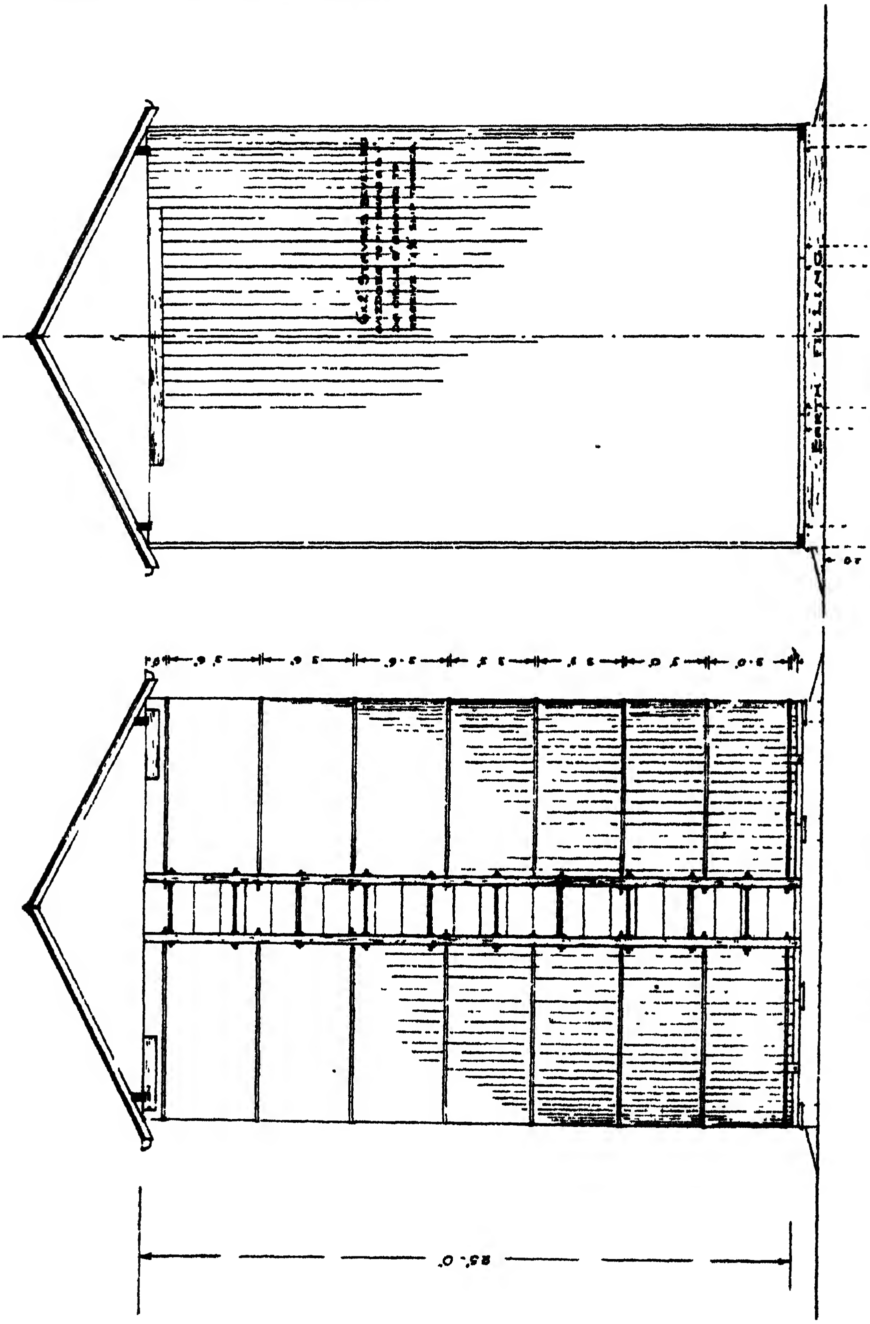

Fig. 1.—Elevation of Wood Stave Silo. **Fig. 2.—Section of Stave Silo.**

Constructed of 6 x 2 in. staves, bevelled on edges to fit round a circle with 16 feet diameter, and grooved to receive 1 x $\frac{3}{8}$ in. slip tongues.

The concrete and the wooden silo can be built so as to preserve the fodder in equally good condition, provided the details of construction are carefully adhered to, and that the structures, once erected, are given proper attention and are kept in good repair. In fact, it is essential to the successful adoption of this method of conserving fodder that the silo be given regular attention, especially on the inside. No silo—no matter of what material it has been erected—will continue to be serviceable if it is neglected and allowed to fall into disrepair.

The Foundations of a Wooden Silo.

Certain features of silo construction are common to both the concrete and the wooden types, and it may be convenient to discuss these first.

For the stave silo that is not to be set any depth in the ground, the foundation should consist of eight pieces of 9 inches x 3 inches hardwood, jointed together to form an octagonal frame, and set on and firmly spiked or bolted down to stumps 12 inches in diameter, set about 2 feet in the ground and standing 6 inches above the ground level. The outside size of this bottom frame is exactly the outside diameter of the silo, so that each of the staves rests on it, and the lower end of one stave in the centre of each length is sunk into and firmly spiked to the kerb to anchor it (see Fig. 1). The object of raising the kerb 6 inches over the ground is to allow the floor of the silo to be filled in to that height all round against sheet iron nailed to the inside of the kerbing and let 2 or 3 inches into the ground. On the outside, the surface is built 4 inches up to the iron against the kerbing timber. As a preventive against white ants plain iron plates should be set on top of each stump (see Fig. 2).

The best method of securing the kerbing to the stump is shown in Fig. 3.

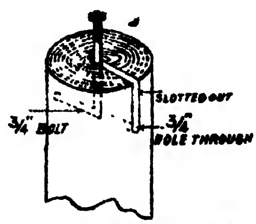

Fig. 3.—Foundation stump, showing how anchor bolt is placed.

Where it is desired to set 4 or 5 feet of the silo under the ground level, the lower portion of the structure should be built of concrete 8 inches thick, and rising to 9 inches over the ground level to form a weathering base. Anchor iron straps may be built into this concrete wall, to be bolted to the lower end of, say, eight staves round the circle. It is most important that the inner face of the concrete and the staves be quite flush, as the slightest ridge will prevent the settlement of the silage. The anchor irons must be on the outside of the staves and the bolt heads must be sunk flush and then covered over on the inside to protect them from rust.

The foundation of the frame silo is very similar to that of the stave (see Fig. 4), and the method of bolting the kerb to the stump is the same as in the previous case (see Fig. 3).

The Foundations of Concrete and Brick Silos.

Apart from the matter of reinforcement, the failure of silos of these types may usually be attributed to insufficient and poor foundations. Water which has been allowed to settle in and around the silo when it is empty often does considerable damage to these silos.

In making the footing of a silo it is well at all times to err on the safe side, and to have a good substantial base for the walls to stand on. A foundation at least twice the thickness of the walls and, say, 9 to 12 inches deep according to the height of the silo, is desirable. The trench in which the footings are to be placed must be cut level on the bottom and to a good hard surface. Any soft spots should be rammed and filled in solid.

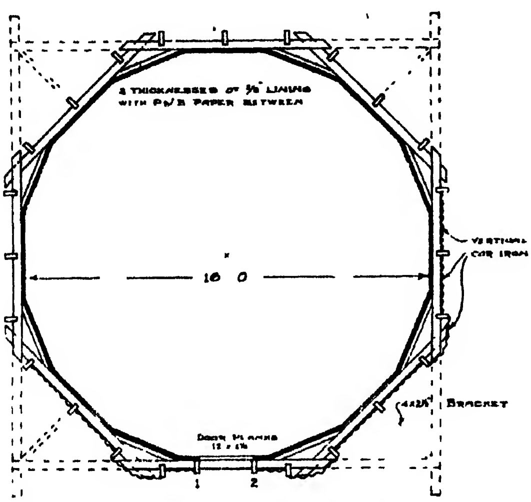

Fig. 4.--Plan of Frame Silo, showing extension of top plates for roof.

The Floors.

If the earth on the bottom of the silo is firm and comparatively dry, no provision need be made for drainage, and paving of any kind is quite unnecessary. On the other hand, if the spot is liable to be damp, it may be necessary to lay a tile drain around the silo to carry off the seepage. If the drain pipe has to be carried into the floor of the silo itself, the inlet end on the floor must be stopped up when the silo is to be filled to prevent the admission of air, which would rot and spoil the silage. The stopping can be removed when the silo has been emptied.

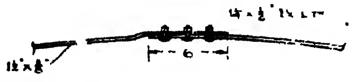
Fig. 5. Detail of joint in flat iron hoop.

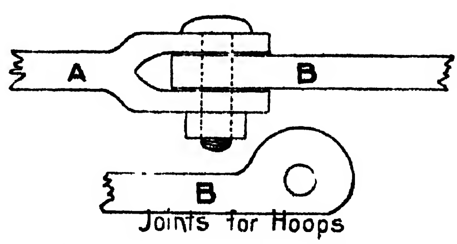

Fig. 6. - Details of joint in round iron hoop.

The Doors.

The door openings of silos have undergone many changes, but it is now recognised that the best type is the continuous opening, with movable slabs of wood, 12 inches wide, set in between prepared rebates in the jambs, and held up with the silage as it is filled in. To make this door air-tight it is

only necessary to lay over the opening a sheet of tar paper, 3 feet wide, and to the full height of the silo. This effectually covers the joints of the frame and slabs.

The usual width between the sides of the door frame is 24 inches, and in the case of the wood silo the door frames could be as shown in Fig. 1.

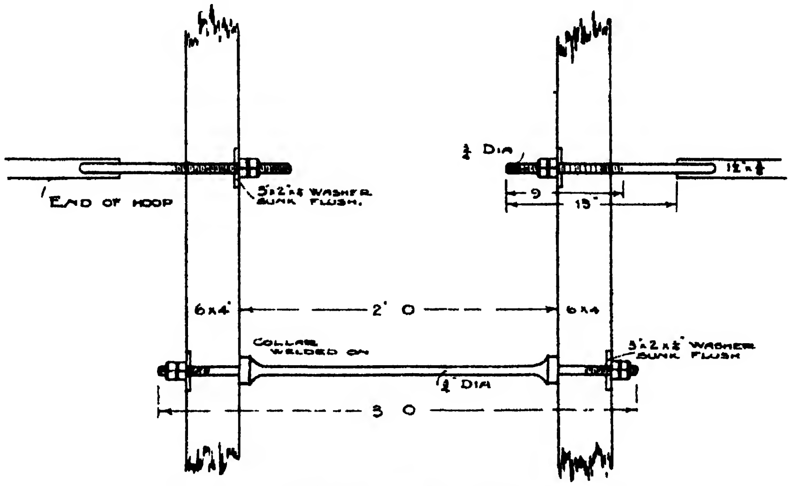

Fig. 7.—Details of Ties, &c., at door frame.

Continuous doors in concrete or brick silos are not so easily provided for, as they require a specially designed form of steel frame to make up for the break in the continuous wall. It is advisable in these types of silos, therefore, to make separate doorways, about 4 feet high, one above the other, with a band of the wall between each two doors.

The Roof.

To be thoroughly neat and finished in appearance the roof of any single silo should be built octagonal on plan, with a dormer opening constructed on one side for the head of the blower-pipe or the elevator. The open gable roof, however, is much more cheaply and easily constructed, is the most serviceable, and looks quite in keeping with other roofs generally to be seen on a farm. The advantage of being able to fill the silo from either side (that is, through either gable end of the roof) is something, and if necessary the ends can be boarded up and a door fitted in them. The construction of a gable roof is shown in Figs. 1 and 2.

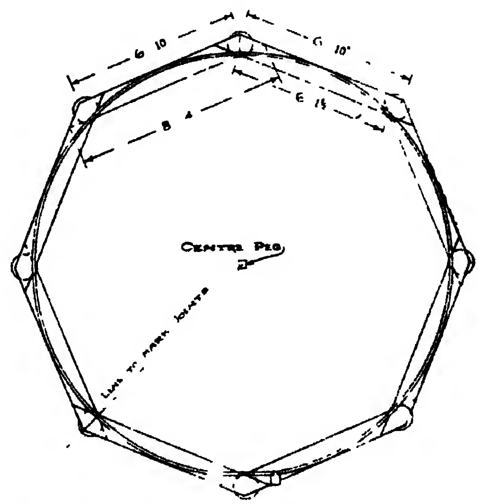

Fig 8. Foundation plan of Stave Silo, showing lay-out of kerbing timbers.

Chute and Ladder.

A chute, built in the form of a three-sided upright box, fixed over the door openings, and carried down to within 5 feet of the floor of the feed room or barn, intended to prevent the silage from scattering when it is being withdrawn, is a very necessary adjunct of all silos.

A ladder is an essential feature of any complete silo, so that the different doors or parts of the opening can be reached from the outside. One may be fitted inside the chute just described, or short lengths of ¾-inch water piping can be made to serve the place of steps by setting the ends in each side of the door frame at intervals of about 18 inches. The tie bolts in the door frame are sometimes also made to serve the purpose. In the absence of any of these, an ordinary ladder, fitted with hanger straps to set over the top of the wall of the silo, may be provided.

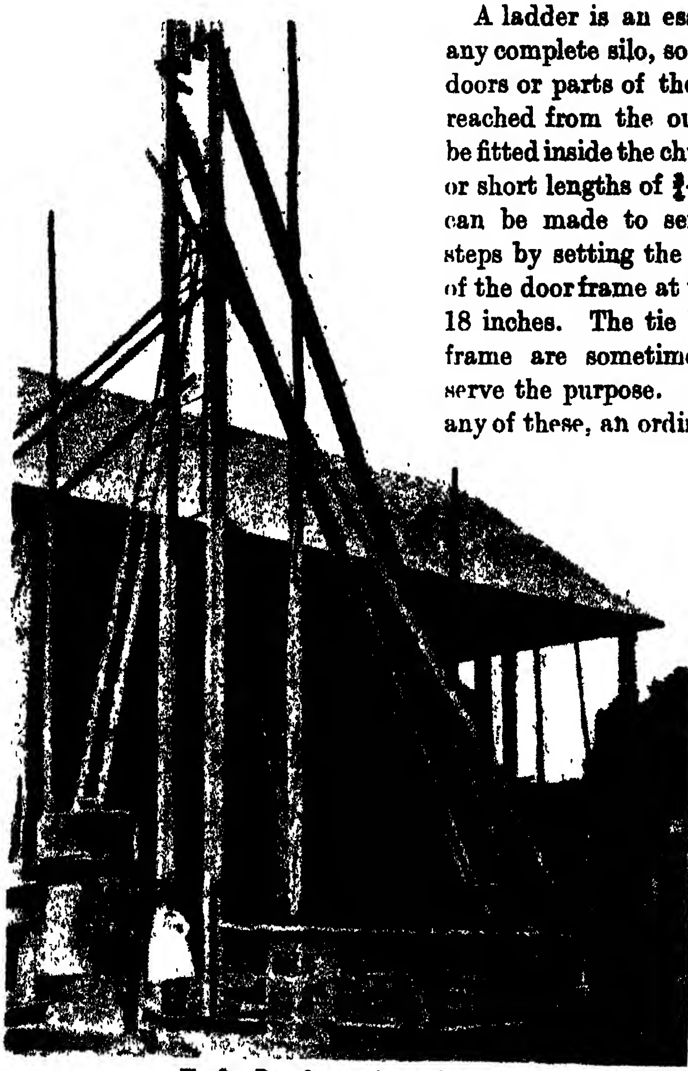

Fig. 9.—Door-frame set up and braced.

The Timber Silos.

One of the most important points in connection with the construction of wooden silos is that the face of the timbers next to the silage shall be perpendicular. This permits the silage to sink freely, a thing it could not do if the timbers were fixed horizontally. It is for this reason that the Department recommends two designs of wooden silo—the stave and the frame silo—both of which comply with this requirement.

The stave silo is practically speaking a barrel, the staves of which are tongued and grooved like flooring boards, and are bound together with wrought-iron bands.

The frame silo, as its name implies, is framed together, octagonal in plan, but with the eight corners filled in to make the inside as nearly round as possible.

Approximately nearly 4,000 feet, superficial, of timber are required in the stave silo, while in the frame silo about 500 feet more are necessary.

Fig. 10.—Putting up the staves.

The great difficulty in building a wooden silo is the purchase of seasoned timber. If the timber for a stave silo is properly seasoned the cost is very heavy indeed, while well-seasoned lining boards for a frame silo can be obtained from ordinary stocks.

Where a stave silo is to be erected of unseasoned timber, it is recommended that it be only partly erected, and that in twelve months' time the

bands be opened out and extra staves (usually two, 6 inches wide) be put in to make up for the shrinkage that has taken place. The scaffolding used for the erection of the silo should be left in position during the year of temporary use, so that it can be used again when putting in the extra staves, fixing the roof, and painting the outside.

The approximate cost of the two types—stave and frame—will be found about equal under these conditions. The stave silo can be erected the more speedily, but the materials are the more expensive, and included in them is about £20 for wrought ironwork, hoops, tie-bolts, &c. It is also necessary to keep the outside face of the staves well painted to protect them from the weather, whereas there is neither hoops, tie bolts, nor painting in the case of the frame silo.

Preference may be given the frame silo, on account of the fact that seasoned lining can be procured for the walls, and it is consequently possible to erect the job complete at once, and not to have to put in extra timber a year later to make up for shrinkage, as is often the case with the stave silo

The frame silo offers the additional advantage, too, that there are no iron bands or tie-bolts to become loose and require tightening up later on, while the outside walls do not require painting to preserve them from the weather, as they are covered with corrugated iron fixed upright on the framework.

In order that the farmer who intends to erect a wooden silo may have all the details before him as to the two types, a complete list of the materials required for each is given.

MATERIALS REQUIRED FOR A STAVE SILO.

Height, 25 feet; diameter, 16 feet; approximate capacity, 85 tons.

Timber—

8 round stumps, 3 feet long, 12 inches diameter.
8 kerbing pieces, 7 feet 6 inches long, 9 in. x 3 in. hardwood.
2 door posts, 25 feet long, 6 in. x 4 in. hardwood.
25 door planks, 2 feet 2 inches long, 12 in. x 2 in. pine.
100 staves grooved, 25 feet long, 6 in. x 2 in. hardwood. (Oregon pine preferred).
100 slip tongues, 25 feet long, 1¼ in. x ⅜ in. hardwood. .. .. ..
4 wall plates, 19 feet long, 6 in. x 3 in. hardwood .. .. ..
1 ridge board, 20 feet long, 6 in. x 1 in. hardwood. .. .. ..
14 rafters, 10 feet long, 3 in. x 2 in. hardwood.
Battens, 300 feet lineal, 3 in. x 1 in. hardwood.
Chute frame, 50 feet lineal, 3 in. x 2 in. hardwood.
„ boards, 12 pieces 16 feet long, 6 in. x 1 in. tongue and groove pine.

Sundries—

8 complete wrought-iron bands, with ¾-inch threaded bolt ends to each, 9 inch long, with double nuts; each hoop in three lengths (see Figs. 5 and 6.).
10 ¾-inch collared tie-bolts for door frame, complete with washers (see Fig. 7).
8 7 in. x ½ inch bolts for roof plates.
18 sheets of roofing iron, 10 feet long.
4 lengths 14-inch ridge capping.
4 lb. 2-inch spring head nails.
14 lb. mixed wire nails.
9 gallons mixed paint.

MATERIALS REQUIRED FOR A FRAME SILO.

Height, 25 feet; diameter, 16 feet; approximate capacity, 85 tons.

Timber—

8 round stumps, 3 feet long x 12 inches diameter.
4 bottom plates, 16 feet long, 4 in. x 4 in. hardwood.
40 pieces for rails, 16 feet long, 4 in. x 2½ in. hardwood.
25 pieces for studs, 25 feet long, 6 in. x 2¼ in. hardwood.
To make angle pieces, 250 feet lineal, 2 in. x 2 in. hardwood.
14 pieces rafters, 10 feet long, 3 in. x 2 in. hardwood.
1 piece ridge, 20 feet long, 6 in. x 1 in. hardwood.
12 pieces battens, 20 feet long, 3 in. x 1 in. hardwood.
Chute frame, 50 feet lineal, 3 in. x 2 in. hardwood.
Chute boards, 12 pieces, 16 feet long, 6 in. x 1 in. tongue and groove pine.
Silo wall boards, 2,700 feet superficial, 6 in. x ¾ in. tongue and groove pine.

Sundries—

2 rolls, 2 ply P. and B. paper.
Roof iron, 18 sheets, 10 feet long.
Wall iron, 46 sheets, 8 feet long.
,, 23 sheets, 10 feet long.
7 doz. 6 in. x ½ in. cuphead bolts, nuts, and washers.
3½ doz. 3 in. x ½ in. cuphead bolts, nuts, and washers.
8 only ¾-inch anchor bolt (see Fig. 3).
42 lb. nails, assorted sizes.
1 lb. ½-inch cut tacks.
4 lengths, 14 inches, ridge capping.
4 lb. 2-inch spring head nails.

How to Build the Stave Silo.

Having collected the materials, a fairly level piece of ground should be selected on which to lay out the foundation timbers. To get the lengths and cuts of each piece first drive a stout peg in the centre of the proposed site, leaving it about 3 inches over the surface, and then into it drive a strong nail. This point becomes the centre from which is marked out the circle that forms the diameter of the inside of the silo. To obtain this circle, use a light batten 8 feet long, cutting a small V in one end and setting it against the nail, and with it marking off the 16-feet circle.

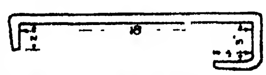

Fig. 11.—Iron dog, of ¾-inc diameter.

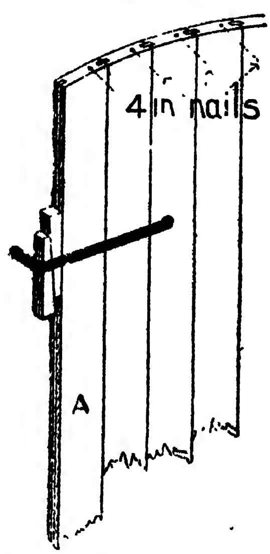

Fig. 12.—Iron dog in position, A being the bent plank.

Laying down the Foundation. The kerbing is to be of 9 x 3 inch timbers fitted together to form an octagon frame, the outside edges of which will take in the full outside diameter of the structure. To obtain the lengths and cuts of the eight kerbing timbers, divide the circle into four and then halve each quarter. On the eight points so obtained lay the inner edges of the 9 x 3 pieces, and a line from the centre over the points on the circle will give the bevel that must be cut on the ends of the large timbers (**Fig. 8**). The joints thus made are bevelled butt joints, and each will be securely spiked to the round blocks which have yet to be sunk in the ground.

A better job would be obtained by allowing the ends to continue over and under each other, halving the corners together and securing each point by bolting it down to the block as shown in Fig. 3.

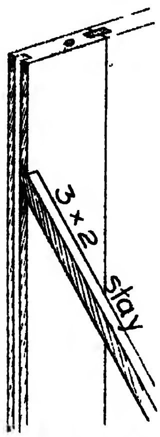

Fig. 13. - Details of use of 3 x 2 inch stay.

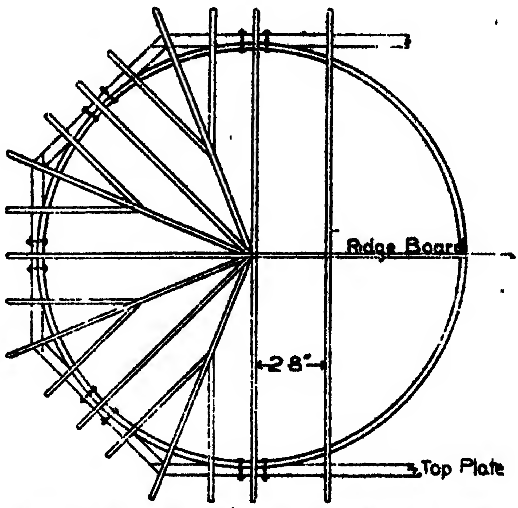

Fig. 14.- Roof plan, showing the fixing of the top plates.

The kerbing frame being thus far made, it may be laid out on the site of the silo, and the corners marked out to give the positions at which the holes have to be dug for the round stumps. These must be set accurately, with the tops quite level, the iron caps must be properly fixed on and (together with the underside of the kerbing) well coated with hot tar. To these stumps securely fix the kerbing and the foundation is ready to set the silo on.

Fig. 15.

Now again take the 8-feet batten used to mark out the first circle, and mark the circle on the kerbing timbers. It is on this line that the inside face of the staves and door-posts is set.

The door frame is first set up, the two 6 x 4 door-posts being rebated 1 inch deep on each side of the 4-inch face, and a depth equal to the thickness of the door planks and the staves on the 6-inch face, right through the full

length, and then bored out to take the round screwed ends of each hoop band and the tie bolts which bind the door frame together (see Fig. 7). The bottom ends of the frame are let ¾ inch deep into the top of the kerbing as indicated on the ground plan, Fig. 8.

The door frame being now up it must be securely braced perfectly plumb, with stays secured to stakes driven into the ground (see Fig. 9). This done, scaffolding is required to enable the builder to get all round the outside of the job. The scaffolding may be four-sided only, with a plank across the corners as required (see Fig. 10).

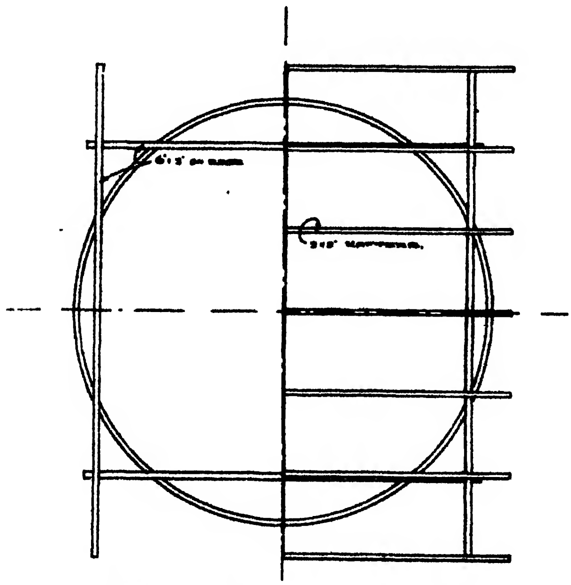

Fig. 16.—Roof plan for Wood Stave Silo.

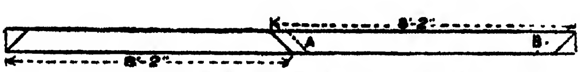

Fig. 17.—Bottom rails cut out of 16 feet length.

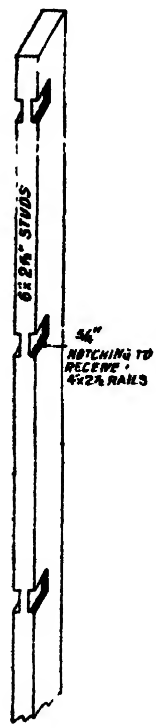

Fig. 18.—Part of stud of Frame Silo.

Erecting the Staves.—The erection of the staves is commenced from the door frame each way, finishing in the centre at the back. The joints and tongues of all timbers must first be coated with linseed oil or thin oil paint before being set up. Each stave may be lightly nailed at the ends to hold it in position, the nails to be withdrawn if the timber is green, but to be driven in permanently if the timber is well seasoned.

If a stave is not quite straight on its edges and requires cramping together, an iron dog and wedges as shown in Fig. 11 may be used. The holes to take the end of this iron dog must not be bored quite through the stave, and must be plugged up when the dog is withdrawn (see Fig. 12).

Occasionally the edges of the staves should be plumbed and stayed inwards as shown at Fig. 13. These stays are lugged at the top ends and sunk in flush as far as the tongue in the joint will allow. To remove them when the silo is finished, simply saw through on the face of the stave, leaving the piece in the joint.

Fixing the Hoops.—Before the hoops are brought into use they should have been painted to prevent them from rusting, and they should be dry when they come to be handled.

Starting at the bottom, they should be screwed lightly into position, care being taken to ensure that they are quite level all round the silo, and hooks or staples should then be driven over them, but without the staves being pierced. When all are set, screw up tightly, using the hammer where necessary to make the hoops lie close to the timbers.

The Roof.—The plates for the roof, whether for an octagonal or a gabled roof, require to be shaped out to fit the outside of the circle and secured to the staves with bolts and nuts (see Fig. 14). For the gable roof it is also necessary to provide stays under the corners of the wall plates, the bottom ends being nailed to the face of the staves.

In the illustration of the "Dreadnought" silo (Fig. 15), it will be seen that the wall plates are simply set on top of the staves and fastened down with hoop iron or wire. This is not sufficient to secure the roof properly though where the staves are green and it is necessary to make up the shrinkage, as described on page 703, this way of putting on the roof might serve for the first year. Another easy method of fixing the roof timbers is shown at Figs. 1, 2, and 16.

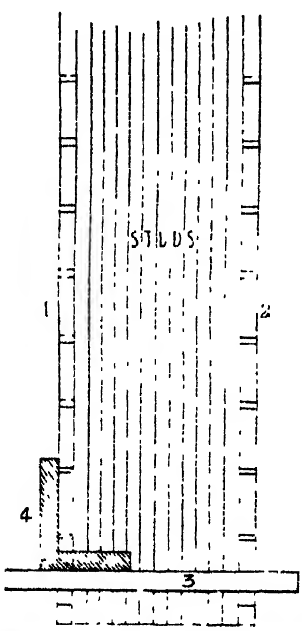

Fig. 19.—Marking out the studding.

The Frame Silo.

For the foundation take the eight round stumps (one for each angle of the octagon), and bore and slot them for the anchor bolt as shown in Fig. 3. These stumps when fixed must also be capped with iron caps, and should be charred or tarred before being set into the ground, the former being the better method.

Mark out the bottom frame, using the 4 x 4 inch pieces, each 16 feet length making two pieces 8 feet 2 inches long at the longest points when marked out, as shown in Fig. 17, the bevel being at an angle of 45 degrees. With the eight pieces so cut, lay out the octagon frame as indicated in Fig. 4. This will measure 16 feet $2\frac{1}{2}$ inches between the sides, allowing for the silo to be 16 feet clear inside when the lining is fixed. Halve the joints together, and through the centre of each bore a $\frac{3}{4}$-inch hole for the anchor bolt to pass through.

With the frame put together, mark out the position of the round stumps, and dig the holes for them, setting them up, ramming the earth hard, and then bolting the frame to each in turn.

The Walls.—The framing of the walls consists of studs and rails notched together in the strongest manner. Fig. 18 shows a 6 x 2½ stud with the notches or housings to receive the 4 x 2½ rails. In this way when the timbers are together the original strength is not reduced, but the fitting must be carefully done, and if the timber is cut to size reasonably accurately there should not be any extra trouble with the fitting.

The bottom frame should be marked out as required, and all the cutting out done. This frame will then serve as a pattern to mark out each of the others. Similarly the studs should be marked out together, as shown in Fig. 19, two only being first prepared and then one, placed on either side of the whole (1 and 2 in the figure), and then with straight edge and square (3 and 4) the whole can be marked at one time.

When these have all been prepared, each of the eight sides of the wall framing may be fitted together ready to be set up as shown in Fig. 20, and when erected securely the corners can be filled in by cutting the 2½ x 2 inch pieces (Fig. 21), and nailing them securely in position. A sixteen-sided silo is thus made, which is as nearly round as possible.

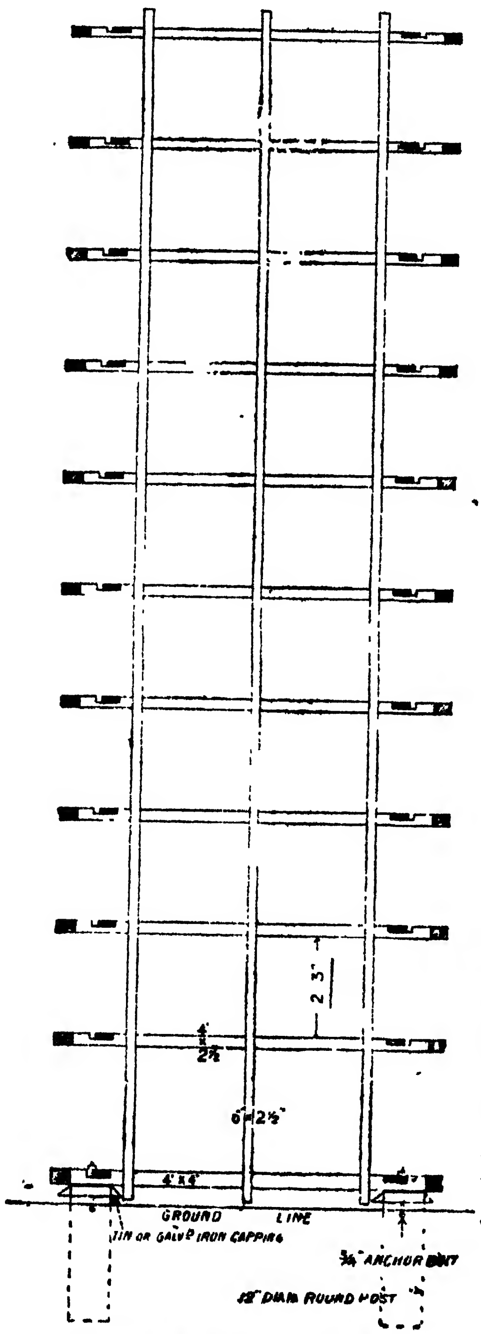

Fig. 20.—One section of Frame Silo.

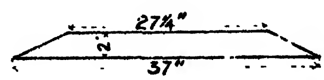

Fig. 21.—Filling piece for corner.

The lining boards must not be nailed on until the roof is fixed and covered, and the corrugated iron is on the outside face of the walls. This is so that if bad weather sets in the lining boards will be fixed while dry.

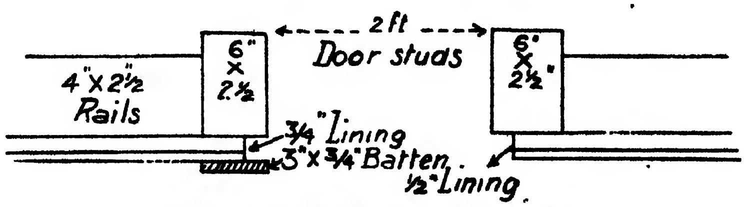

Fig. 22.—Details of door opening of Frame Silo.

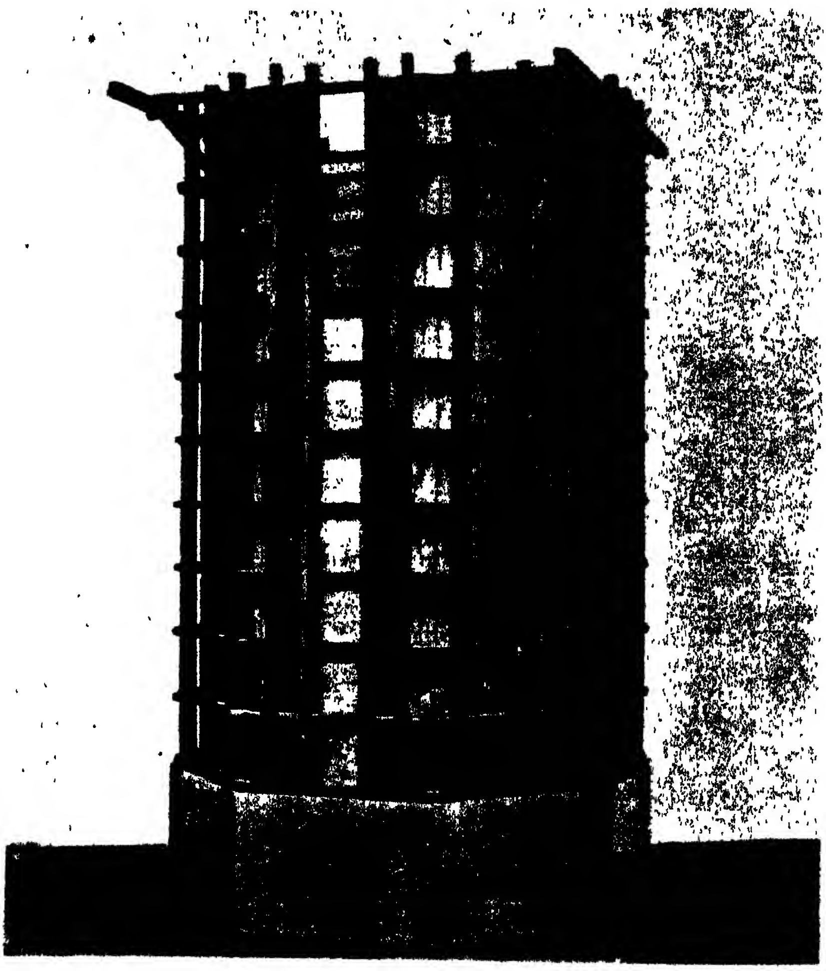

Fig. 23.—Frame Silo on Concrete Base.

Starting at one side of the door, with a plain edge, double nail to each rail and close to the studs the first thickness of lining. When it has been completed, lay over this P and B paper in single strips 3 feet wide the full height of the

silo, and nail over it the second layer of lining boards, taking particular care that the joints of the second thickness are over the centre of the first thickness of boards. At all angles the boards should be splay-jointed over each other, and close nailed. If both thicknesses of the lining are carried around the silo together less scaffolding and ladders will be required, as the framing of the walls provide suitable ledges to rest the ends of the planks on.

The Door Frames.—On the side where the door openings are required (at 1 and 2 on Fig. 4, the studs are set back flush with the inside of the rails. The door planks are 1¼ inches thick, to correspond with the thickness of the double lining boards on the walls, and at one side of the door a rebate is formed to receive the end of the door plank (which is checked out correspondingly), the other end being cut off square. The rails are about 27 inches apart, making the door openings amply large enough, and providing a useful ladder (see Fig. 20).

The Roof.—As with the stave silo, the roof may also be octagonal in shape, but the plain gabled roof is easiest to construct. For the gable roof it is only necessary to extend the top rails as indicated by the dotted lines on Fig. 4. The gable rafters may be up to 3 feet beyond the silo walls, thereby affording good cover. Fig. 23 shows this silo erected over a concrete base, which may be 4 to 5 feet into the ground, and indicates how the roof plates are extended and supported by the brackets at the corners.

Painting.—While it is essential that the timbers that are exposed to the weather shall be coated with paint, it must be borne in mind that no lead paints must be put on the inside of the silo.

The inside of wood silos should be regularly coated with raw linseed oil, and it is recommended that as the silo is being emptied (at each 5-feet depth over the silage) the face of the staves or lining boards should be brushed down and a coat of oil applied. This saves the trouble of doing it off a ladder later on.

To the outside of the stave silo, when first erected, three good coats of lead and oil paint should be applied, and at periods of three years another coat should be applied to keep the silo in good condition. White is the best paint to use, and it should be mixed with a very little vegetable black—though not enough to colour the white paint.

The outside of the frame silo, being iron, requires no paint to preserve it, but if a lime-wash or water paint is put on it adds to the appearance of the silo.

(To be continued).

The rapid development which has occurred in utilising the underground water resources of the State in the past ten years is evident from the fact that the number of successful bores of all kinds increased from 485 in 1911 to 1,282 in 1922.—*Official Year Book of New South Wales.*

THE PRODUCTION OF RED WHEATS.

THE question of the advisability of discouraging the growing of red wheats in the Commonwealth was fully discussed at the Interstate Conference of Ministers of Agriculture, held in Melbourne recently, it being stated that wheat exported to Great Britain and elsewhere suffered a dockage in the event of any red varieties being present. It was pointed out that as Australia had a name for growing white wheats, the cultivation of the white varieties should be fostered, and that the Australian reputation should not be permitted to be damaged in the markets of the world by allowing small quantities of red wheats to be included in consignments. As a result of the discussion it was resolved:—

(*a*) That this Conference considers that the Departments of Agriculture of the various States should use efforts toward discouraging the growing of red wheats in the Commonwealth.

(*b*) That no red wheat should be distributed for commercial sowing from State farms and colleges, and that the Royal Agricultural Society of each State be asked to eliminate red varietes of wheat from their wheat competitions.

The matter was also discussed at a meeting convened by the Minister for Agriculture in this State (the Hon. F. A. Chaffey.) This meeting, at which representatives of the Chamber of Commerce Voluntary Wheat Pool, Farmers and Settlers' Association, Primary Producers' Union, Chamber of Agriculture, and millers and shippers were present, unanimously decided in favour of the resolutions adopted at the Ministers' Conference.

The Department is taking action on the lines suggested, but is also taking steps to ensure that seed of the strong red wheats that have given good results under certain conditions shall not be lost. The plant breeders of the Department are concentrating on the production of white grained varieties to take the place of such sorts as Bomen or Warden, which, though possessing qualities that make them popular with farmers in some districts, have the red grain to which exception is taken.

THOMPSON'S IMPROVED AND NAVELENCIA ORANGES.

IN the issue of this journal, dated July, 1920 (page 519), appeared a report regarding the oranges known as Thompson's Improved and Navelencia, the identity of which had at that time been under discussion. A comparison of the two fruits was made on the 16th August of this season, from trees imported from California and grown at Hawkesbury Agricultural College. The Thompson's Improved trees were planted in 1904 and the Navelencia in 1910, having been worked on sweet orange seedling stock. The outward appearance of the two varieties was very similar. Thompson's Improved was not as smooth in the skin as is generally characteristic of that variety. Neither variety showed any sign of dryness, both being very juicy. The Navelencia was of superior internal texture to the Thompson's, and its flavour was slightly more acid but had more snap, the Thompson's being inclined to be insipid. The Thompson's showed no signs of seed, but odd seeds, some fully developed were present in the Navelencia.—W. J. ALLEN

Clarence River Maize-growing Contest.

Season 1922–23.

E. S. CLAYTON, Agricultural Instructor.

A MAIZE-GROWING contest, similar to that carried out in 1921, was conducted by the Clarence Pastoral and Agricultural Society last season. These contests are designed to determine the highest yielding strain of maize in the district, and are creating a good deal of interest and healthy rivalry among the best maize-growers of the Clarence River.

Thirteen entries were received from local maize-growers, an increase of four over the previous season. Altogether seventeen entries were received, four being non-competitive entries, made by the Department of Agriculture, of varieties from the Grafton Experiment Farm and the lower coastal rivers.

The Varieties.

The winning variety, entered by Mr. W. T. Boyd, was of the Yellow Horsetooth type, with an admixture of Fitzroy, seed of which was procured from Grafton Experiment Farm. The grain was deep, of fair colour, and free from weevil, but was rather soft and starchy, with a pinched dent. This variety is undoubtedly a high yielding strain, but requires much improvement in the type of grain to make a good sample.

The variety to come second in the contest was entered by Mr. T. H. Coles. The grain was of the Fitzroy type, with a infusion of "blood" from the Experiment Farm, but it was somewhat rough-dented and starchy it was of light colour, but fairly uniform in size and shape. Mr. Coles also had another entry, a strain similar to the former, but with grain of better colour, slightly thicker and not so rough dented.

The seed entered by Mr. F. R. Crispin was of the Fitzroy type, and was a very good sample of grain, presenting a very attractive appearance.

Of the two entries made by Mr. T. J. Ford, one was of the Fitzroy type, with an admixture of Yellow Horsetooth, comprising an excellent sample of good colour and appearance. The other was of the Yellow Horsetooth type, with a trace of Fitzroy. The grain was tinged with red, and much darker in colour than the former strain.

Mr. D. E. Weeks entered a variety very similar to the Fitzroy from Grafton Experiment Farm, except that the grain was somewhat deeper and of a softer and more starchy character.

Mr. H. J. Dix entered a variety of Fitzroy type, with a slight admixture of Yellow Horsetooth, and one of Boone County White type, which was too early maturing to compete with the late-maturing varieties included in the competition.

Mr. W. H. Paine also made two entries—one of the Pride of Hawkesbury type, which was rather a mixed sample, and the other of Whitecap Horse-tooth type, with rather rough-dented, deep, soft, starchy grain, very pale in colour.

Mr. Miller, who was so successful in the previous contest, entered his variety, Ulmarra Whitecap. This variety, which has been very successful in maize-growing contests on the lower North Coast rivers, again demonstrated its high yielding ability on the Clarence.

Mr. W. S. Leonard entered an excellent sample of Fitzroy. The grain was of good colour, and presented a very attractive appearance. This variety came third in the contest, thereby proving its high yielding capacity. Producing grain of very good type also, this constitutes a valuable strain of maize.

In addition to the above varieties, the Department of Agriculture made four non-competitive entries. These consisted of Pride of Hawkesbury, Yellow Hogan, Large Red Hogan, and Fitzroy. The Fitzroy was secured from Grafton Experiment Farm, where a system of careful selection for a number of years has resulted in the production of a fairly high yielding, pure strain of maize, of excellent type and quality of grain. The other varieties were obtained from farmers on the lower coastal rivers, where these varieties are largely grown. They are not as suitable, however, for the Clarence River district as they are for the districts bordering on the lower rivers.

The Plots.

By the courtesy of Messrs. W. T. Boyd, Carr's Creek, and H. McLachlan, Ulmarra, tests were conducted at both these centres. The land in each case was fertile, alluvial loam, typical of the best maize land of the Clarence River district. In each case also the previous crop was maize. No artificial fertiliser was used in the contest. The land was well prepared, and contained a moderate amount of stored moisture at the time of planting. The seed was planted by hand to secure absolute uniformity. On Mr. Boyd's farm the rows were 4 feet 4 inches apart, and four grains were dropped every 3 feet. On Mr. McLachlan's farm the rows were 4 feet apart, and three grains were dropped every 2 feet 9 inches.

The Season.

The season was among the driest experienced on the Clarence River; many of the early-sown maize crops failed altogether, and some of the late-sown crops were partial failures. Planting was carried out on 14th December at Carr's Creek, and on 19th December at Ulmarra.

December was very dry. During January 352 points were recorded, but for February the registration was only 1 inch, and as this month is a critical time for December-sown maize and the low rainfall was coupled with drying winds and high temperatures, it is remarkable that such good

yields were obtained. March was also dry, only 185 points being recorded, In April 753 points were received, but this, of course, was rather late to be of use to the crop. The crops were harvested on 2nd June at Ulmarra, and 11th June at Carr's Creek.

AWARDS in the Clarence River Maize-growing Contest, 1922–23.

Competitor	Variety.	Yield at Carr's Creek.		Yield at Ulmarra.		Average yield of shelled grain.		Shelling percentage.
		bus.	lb.	bus.	lb.	bus.	lb.	
W. T. Boyd ...	Yellow Horsetooth ...	101	0	102	35	101	49	84
T. H. Coles (No. 1)...	Fitzroy	92	49	100	10	96	29	83
W. S. Leonard ...	Fitzroy	88	21	97	13	92	45	84½
A. J. Miller	Ulmarra Whitecap ...	101	50	81	29	91	39	84
D. E. Weeks ...	Fitzroy	91	55	84	26	88	12	84
F. R. Crispin ...	Fitzroy	92	49	83	4	87	54	83
*Department of Agriculture ...	Fitzroy	91	4	78	32	84	46	84½
T. H. Coles (No. 2) ...	Fitzroy	87	26	81	29	84	27	85½
T. J. Ford (No. 1) ...	Fitzroy	92	49	70	40	81	44	84½
H. J. Dix (No. 1) ...	Fitzroy	91	4	71	39	81	21	84½
W. H. Paine ...	Whitecap Horsetooth	74	47	87	23	81	7	82
T. J. Ford (No. 2) ...	Yellow Horsetooth ...	91	4	60	50	75	55	84½
*Department of Agriculture	Yellow Hogan ...	75	42	61	49	68	45	86
*Department of Agriculture ...	Large Red Hogan ...	72	8	64	52	68	30	83½
W. H. Paine ..	Pride of Hawkesbury	65	46	67	33	66	39	82
*Department of Agriculture ...	Pride of Hawkesbury	73	53	58	52	66	24	84
H. J. Dix (No. 2) ...	Boone County White	54	6	43	12	48	37	91

* Non-competitive entry.

Comments.

The Department of Agriculture's certificate of merit and the Society's certificate and prize of £5 go to Mr. W. T. Boyd, Carr's Creek, and the second prize of £2 to Mr. T. H. Coles, Clarenza. It is remarkable that such excellent results should have been obtained in such an adverse season. They speak volumes for the strains of maize entered. and show their ability to yield remarkably well even under comparatively dry conditions. They also illustrate the advantage of having well-prepared land, in which, by early and thorough cultivation, sufficient moisture has been conserved to enable the crop to withstand dry periods.

There is room for a good deal of improvement in many of the varieties, so far as type of grain is concerned. Growers should not neglect this aspect. It has been found that these soft, starchy types of grain are much more liable to disease and to damage by the weather, and it is therefore advisable in selecting to get away from the soft, starchy types, and to aim at the

production of high-yielding strains with grain of good quality. This is particularly the case with the Horsetooth types, in which a large amount of spoilage occurred this season. It was also noticeable in some of the Fitzroy types, which had not been well selected.

The variation in the yields of the same variety at Ulmarra and Carr's Creek is in some instances rather striking. The maize entered by Messrs. Ford, Miller, Weeks, Crispin, Dix, and the Department's Fitzroy, all yielded much better at Carr's Creek than they did at Ulmarra. On the other hand, the varieties entered by Messrs. Boyd, Coles (No. 1 entry), Leonard, and Paine yielded better at Ulmarra.

A good deal of interest is now being evinced in the contest, and the results are very gratifying; without doubt the contest is having a marked effect on the standard of the strains of maize grown on the Clarence. It is anticipated that the contest to be inaugurated this season for early maturing varieties will arouse an interest no less keen.

"Forest Insects of Australia."

Although a number of forest insects have been described and identified in dealing with the plants upon which they feed, comparatively little systematic research has so far been done with the insect pests of our forest trees as such. This work, in which Mr. W. W. Froggatt, F.L.S., F.E.S., late Government Entomologist, deals with them exclusively, is therefore both welcome and opportune.

Introducing his subject the author points out that "Australian forest trees are no more immune from insect infestation than the forest flora of other parts of the world. In fact, our native trees are more open to attack, because we have no efficient feathered allies, such as the woodpeckers of Europe and America, who wage constant war upon all wood-boring beetles, moths, and their larvae." The greater part of the work is published for the first time, though associated with it is other information previously recorded by the author and other workers. The result is 170 pages of authoritative, well-indexed, and excellently illustrated matter, including two finely-coloured plates.

There is a fund of information regarding white ants, timber borers, and forest insect pests generally, and those interested in forestry, architecture, and industries in which wood as a material is employed will find it an invaluable text and reference book. As remarked in the preface, by the Hon. W. E. Wearne, Minister for Forests, the extent of the injury done to timber by insect pests is hardly realised, and if the economic loss could be estimated the public attitude toward the introduction of borer and other pests from abroad, and to the urgent need for protective and remedial measures, would be much less apathetic than it is.

Our copy from the Forestry Commissioners of New South Wales, under whose direction the book has been printed and published by the Government Printer, Sydney, from whom copies are obtainable at 7s. 6d.

Practical Methods of Maize Improvement.

H. WENHOLZ, B.Sc. (Agr.), Special Agricultural Instructor *

THE first duty of a maize-grower is to grow a variety which, in comparison with others, stands high under his conditions for yield and quality. The farmer can usually be depended on to pursue this phase of maize improvement with interest and zeal, especially if variety trials are carried out by him or by other farmers in the district. There is, however, a possibility that it may be pursued with too much zeal, to the extent of changing too frequently from one variety to another, with a slight increase in isolated seasons. The aim should be to choose a variety that will produce a comparatively high yield and good quality maize when tested over a series of years. Then the grower should keep to that variety, maintaining and improving it by selection or breeding.

The improvement of the yield of a variety of maize by selection is a subject in which almost every maize-grower is interested, for the crop lends itself so easily to selection that it practically forces itself on the farmer, who (except where the operation is performed by machinery) has to handle each individual ear for husking. By far the greatest number of maize-growers in Australia practise mass selection, and, despite the qualified support of plant breeders for this method of selection as applied to other crops, there is something to be said in favour of its use by the farmer with maize.

The power of mass selection in developing characters more strongly within the variety is strikingly shown by American experiments in selection for protein and oil content, and its influence in developing or changing the type of ear and plant is also illustrated in the well-known characteristics of American varieties like Leaming, Reid's Yellow Dent, Boone County White, and varieties of Australian origin such as Fitzroy, Craig Mitchell, and Golden Superb. It would appear that qualitative improvement without consideration of yield is quite easy of accomplishment by mass selection, and if with this improvement in quality the yield is but maintained, it makes mass selection as practised by farmers well worth while. That the yield is at least maintained by mass selection—despite somewhat close selection to type and the consequent likelihood of the coupling of homozygous individuals, with its supposed effect of reducing the vigour and yield—is shown by the continued high-yielding characteristics of some of the varieties mentioned (which have a high uniformity) under certain conditions of soil and climate.

* Paper entitled "Practical Methods of Improving the Yield of Maize by Breeding and Selection," read before the Pan-Pacific Science Congress, Agriculture Section, Sydney, August, 1923.

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The question arises whether mass selection in maize may not improve the yield. It must not be forgotten that in maize the opportunity for improvement by selection is greater than in any other crop, because the individuals are larger and can be subjected to a more discriminating study. Growers are usually fairly alive to the benefits of the selection of sound—*i.e.*, free from damage by insects or disease—mature, plump, heavy seed, and in these characters alone they must be making some hereditary improvement when the amount of poor grain produced in the same crop is considered, especially when the selection is done in the field. A number of other characters in the plant or ear are, however, visible, and a vast amount of work has been done in America and in this country in the endeavour to establish some correlation between these visible characters in the plant or ear and yield, but it has met with little or no success. It is still thought by the writer that correlations between some visible characters and yield exist for certain varieties of maize under certain conditions of soil and climate. This view is borne out by the following facts:—

1. Flint or semi-dent, single large ear dents and small-eared prolific types have been found to be closely associated with yield under the respective conditions of short season or dry climates, good climatic and soil conditions, and long-season districts of abundant rainfall.

2. Hickory King maize has not so far been troubled with a compeer on land of poor or moderate fertility with good rainfall conditions.

3. A deep, fairly starchy, type of maize seems to be associated with yield under optimum conditions of soil and rainfall, while a short, horny type of grain is apparently best under less favourable conditions in the same district.

There has been distinct evidence also in recent years that the selection of very soft starchy grain is more associated with cob rot and related diseases, and therefore lowers the yield in many districts.

With the large number of ears farmers usually handle in selecting their seed, and the number of different visible characters that appear in the variety, it is not surprising that farmers have come to associate, rightly or wrongly, certain characters with yielding capacity. Many farmers who have never gone beyond mass selection have dogmatic views on these correlations of type and yield, which is a grievous error to fall into. Even the determination of correlations of any characters with yield by the examination of the progeny in ear-row tests is not the simple matter that it might appear. The reason of this difficulty lies in the fact that a single visible character in the ear has only a portion of its value in determining the progeny, because of the promiscuous, unregulated, and unknown male percentage. Further, the influence of any one character on yield is difficult to measure, because of the inseparable influence of other characters. There is, however, sufficient evidence to show that the characters valued by many farmers (such as deep grain, thin core, well-filled tips, straight rows, and high shelling percentage) are not necessarily correlated with high yield; in fact, it has been found

that the yield is adversely affected when too rigid selection is made for these characters, as is done by some farmers. If, then, farmers will become less positive on these points and will give more attention to the selection, especially in the field, of sound, mature, plump, heavy seed of a variety suited to their conditions, it is possible that in mass selection they have a means of improving (if slowly) the yield as well as the quality of their maize.

Stress has been laid in the foregoing on mass selection because it is, after all, the method used by 90 per cent. or more of our maize-growers, and even when methods of breeding are employed for a small plot by the farmer or by the experiment farm the bulk of the seed for the farm area is mass selected. If, therefore, better methods of mass selection can be applied, the benefit to the State will be correspondingly greater than that from a scientific method of breeding that is so technical and involved that it can only be carried out intelligently by a few, even though the results of such a method are more marked.

The ear-row test method of breeding a variety of maize which is not very uniform in type or which is in the process of adapting or acclimatising itself to new conditions, has been found to effect rapid improvement both in quality and yield, but it seems of doubtful advantage to continue it after a few years without making some provision against too close breeding and consequent loss of vigour. This danger is obviated by the inclusion in the ear-row test of ears selected from time to time from the bulk or farm area, or from an unrelated strain of the same variety from other maize-growers. With this provision and with alternate check rows sown with seed from the "breeding plot" (the small plot sown with residues of the best yielding ears in the previous year's ear-row test) it will be found possible to carry on the ear-row test for a much longer period with advantage.

After some years' experience, it has been found that the ear-row test is a method which does not appeal to farmers, largely because they have not the time to go to the extra trouble involved in planting and harvesting the test. This method is therefore restricted chiefly to the Department's farms, and to a few private breeders who are sufficiently interested in the method to find time to carry it out.

There is no necessity to describe here the method of breeding maize which is stated to give such excellent results in America—namely, the crossing of inbred strains (self-fertilised lines). In this method many years of self-fertilisation is required to bring a line into a pure, homozygous and stable condition. The tedious work involved in self-fertilisation, and the care and patience required before results can be obtained, preclude this method from being undertaken by the average farmer, and restrict its use to the experiment farm, where, also, only one variety of maize can be grown. Many pure lines must be grown, and if only twenty are used, 380 different combinations must apparently be made, and each kept pure and tested for yield to discover the highest yielding cross. Jones, of the Connecticut Experiment

Station,* reports the yields of twenty-five crosses between inbred strains of Leaming. Of these, fourteen produced more, and eleven produced less than the original variety. On account of the poorly developed seed from the crossing of inbred strains, double crossing is resorted to. This means ninety more combinations to keep pure and test out for yield if the original twenty pure lines are grown. When the best double combination is found, if the discovery is to be of wide practical value, the seed must be distributed to farmers each and every year, because the vigour due to re-combination of heterozygous characters can only be expected to occur in the first generation. If second and subsequent generations are grown by the farmer—whom it would be difficult to induce to discard a maize which has done so well for him—loss of vigour and yield will result from the increasing tendency for the combination of homozygous characters, and the advantage is questionable.

There is, however, a ray of hope that there may be obtained by this method of selection in self-fertilised lines an improved strain of maize that can be safely distributed to farmers and can be grown for many years without any loss of vigour and yield by close fertilisation. This hope is based on the claim that individuals with defective germ plasm suffer total extinction when self-fertilised for some time, though they may produce fair ears when bolstered up with cross-fertilisation. If this is really the case, then a re-combination of all the self-fertilised lines after many years' "selfing" should result in a strain of maize much superior in yield to the original variety, since a good deal of the defective germ plasm will have been entirely eliminated. If this be so, considerable trouble will be saved in isolating many strains, in effecting many different re-combinations, and in keeping them pure and testing them for yield, and an improved strain of maize will be evolved which can safely be distributed to farmers. This is the system which is to be tried out in New South Wales.

In the meantime, some very practical success in maize improvement is being achieved by conducting yield contests for the best seed in many of the large maize-growing centres of the State. In these contests competitors have to submit for test 10 lb. of their seed maize, and a plot of each competitor's maize is grown under comparable conditions on each of three farms in the district. It is being found that some of the highest yielding seed in these contests is possessed by farmers who have been procuring seed of the same variety from different sources with the idea of getting fresh "blood" into their maize. It will be seen that a principle similar to the crossing of inbred strains is here involved, and that the "strains" (if such they may be called), though not inbred, may be "close-bred," each to a slightly different type, by the selection of the various growers from whom they were obtained, apparently acquiring, when re-combined, increased vigour and yield from the meeting of heterozygous characters.

* Connecticut Agr. Expt. Stat. Bull., 207 (1918).

This is a method that may well be recommended to farmers—because it has produced the results, because it can be applied on a large scale and a wide distribution of seed can be made (as has already been done), and because such an increased yielding "strain" of maize can be expected to maintain its high yield by mass selection for many years. The economic importance to the State of this method of maize improvement must certainly be considered. A significant feature of this improved seed is that in each case seed from an experiment farm formed portion of the "blood," and had a considerable influence in improving the quality. It is only natural to expect that on the experiment farms, where more time can be given to breeding and selection, a better quality of maize will be produced than can be obtained by the average farmer, and if the yield of the farm selection is maintained there may here be indicated perhaps the most helpful function of the experiment farm—namely, to supply a high-yielding strain of good type, which farmers may infuse into their own maize of the same variety to increase the yield and raise the quality.

Very little experience has been gained with the crossing of varieties to test the yield of the first generation crossbred seed in New South Wales, but a few farmers are attempting the evolution of new varieties by crossing two or more varieties—some with apparently fair success. It will be seen that maize improvement in New South Wales has had, and continues to have, essentially an economic aspect. No investigations have been made here in technical genetics, such as are possible in America, but methods of breeding or selection are examined for their practical value, and to determine how the majority of the maize-growers of the State may make use of them in the effort to improve the yield and quality of their crop, and so bring about a condition of greater prosperity in the nation's maize-growing industry.

To Prevent Crystallization when Bottling Honey.

There is no sure treatment of honey to prevent crystallization, but it is possible to retard crystallization—in some cases almost to the point of absolute prevention. The main thing is to bottle and seal the honey in a warm state. Honey is usually received from the apiarist in sixty pound containers. It can be heated by placing the containers in a large shallow vat holding sufficient water to come within three inches of their tops. The water is heated and its temperature maintained evenly at about 150 degrees Fahrenheit, by steam delivered into it by pipes. When the honey has been heated it is poured into fairly large tanks which are kept warm for a few hours before their contents are bottled.

A clean hose is generally used for convenience when bottling the honey. Bottling firms sometimes desire to heat the honey in bulk in the tanks, which are then fitted inside with a spiral tube through which is circulated hot water or steam. In such circumstances, of course, the use of the vat is not necessary. It is always desirable, however, for some honey may be in a crystallized state when purchased for bottling.—W. A. Goodacre, Senior Apiary Inspector.

Farmers' Experiment Plots.

Maize Experiments, 1922–23.

North-western District.

MARK H. REYNOLDS, Senior Agricultural Instructor.

The following farmers co-operated with the Department in maize experiments during the season 1922–23 in the north-western district:—

Jay and Hollow, Ben Lomond.
A. E. Cosh, Mount Russell.
Alford Bros., Scone.
H. Manser, Sunnyside.
H. F. White, Guyra.
J. T. Elliott, Armidale.
W. Lye, Loomberah, near Tamworth.
W. G. Geyer, Tenterfield.
J. McDonald, Inverell.
W. G. Chaffey and Sons, Nemingha.
J. Brake, Narrabri.
G. Smith, Wee Waa.
L. Latham, Baan Baa.
H. A. Wilson, Quirindi.
H. Webber, Red Range, Glen Innes
H. Weller, Ben Lomond.
E. Wilcox, Armidale.

The plots of Messrs. J. Brake, G. Smith, L. Latham, and H. A. Wilson gave unprofitable results from a grain standpoint owing to dry conditions. Mr. H. Webber's plot had the grain washed out by a severe thunderstorm, and the crop on Mr. Weller's plot was damaged by frost.

The maize crop in the district was light in grain yield, but a good vegetative growth resulted from the rains that fell in the spring and on to December. It was the shortage of rain (especially at Inverell) from January to April which changed the prospects of a 70-bushel crop to one of only half that amount. The maize stalks were, however, a boon to stockowners, and Inverell and Delungra districts lost few cattle compared with other parts. One farmer fattened cows in a paddock of stalks and obtained 5s. per head per week for the grazing. Elsewhere the stalk growth was not so prolific, but it proved valuable in assisting to maintain flocks and herds.

Rainfall Records.

Month.	Scone.	Mount Russell.	Guyra.	Armidale.	Inverell.	Loomberah.	Ben Lomond.
	points.	points.	points.	points.	points.	points.	points.
September ...	...	...	...	...	...	42	...
October ...	202	248	...	...	129	212	...
November ...	35	195	113	117	184	63	343
December ...	331	150	126	477	394	*	721
January ...	169	210	218	223	344	*	304
February ...	...	...	19	24	168	*	61
March ...	...	...	216	207	131	*	238

Rain benefited the crops at Guyra and Armidale during April, but the 185 points registered were spread over 19 days.

* Falls of no value.

When grown west of the Dividing Range maize is little damaged by weevil as a rule. Considering the value of the crop apart from the production of grain, farmers would be well advised to devote some land to its cultivation yearly. Sowing should be withheld until the severe frost period is over, though young maize will withstand light frosts.

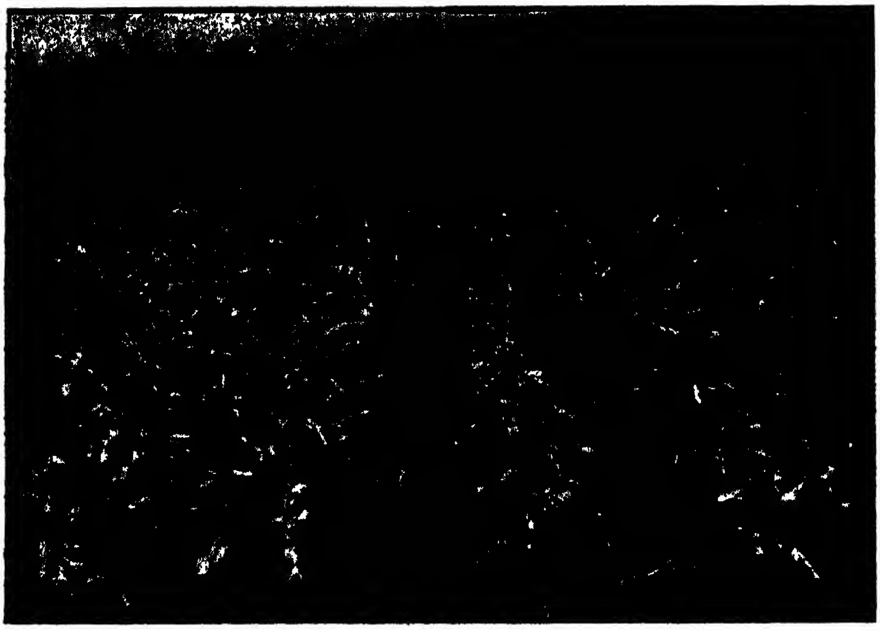
In most cases in these trials the seed was sown by hand in drills 3 feet 8 inches to 4 feet apart, three grains being planted about 3 feet apart and covered with cultivator or harrow. Three rows (about 4 chains each in length) were devoted to each variety or fertiliser tried.

RESULTS of Variety Trials.

Variety.	Scone.	Guyra.	Ben Lomond.*	Inverell.	Mount Russell.	Tenterfield.	Loomberah.	Nemingha.	Armidale.
	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.
Eureka	42½	...	...	9	35	...	8	...	...
Leaming	40	...	...	11½	...	...	...	...	...
Funk's Yellow Dent ...	42	...	...	10	33¾	17	...	15	...
Leggett's Pride ...	39½	...	...	11	33½	...	...	11½	...
Iowa Silvermine ...	51½	...	...	12½	39¾	22	17⅓	8	...
Minnesota 23	...	20⅓	16½	...	...	...	...	...	...
Early Canada Flint ...	...	19½	...	...	...	...	...	.	...
Pride Bald Blair ...	...	18⅔	...	...	...	...	...	...	...
Sundown	...	25	24½	...	...	...	...	...	...
Early Morn	...	26¾	47	...	31	29¼	20½	5⅓	18½
Golden Glow	...	22¾	10½	...	...	27	19	7⅓	20⅓
Gold Coin	...	...	16⅓	10	...	...	12⅔	11	17¼
Wellingrove	...	...	21½	...	39¾	25	16	13	14
Goldmine	...	...	...	9	...	...	...	...	10½
Golden Superb ...	...	...	...	9½	32¾	27	10	8	11½
Kennedy	...	...	...	...	37	26½	...	19	17
Ross' Yellow Dent ...	...	...	...	...	...	21	...	...	...

Except at Tenterfield, where M 12 mixture (superphosphate 10 parts, sulphate of ammonia 4 parts, chloride of potash 3 parts) was applied at the rate of 130 lb. per acre no fertiliser was used in these trials.

* Land water-logged in December, affecting yields considerably.



Maize Variety Trial at Guyra.
In the centre three rows of Sundown; Pride of Bald Blair on the left; Early Morn on the right.

Results of Manurial Trials.

Fertiliser per acre.	Guyra.	Ben Lomond.	Ben Lomond.†	Inverell.	Tenterfield. (W. G. Geyer.)	Tenterfield. (H. Manser.)	Armidale.
	bus.	bus.	bus.	bus.	bus.	bus.	bus.
*M 12, 119 lb.	19½	25½	54½	...	...	28½	48
Superphosphate, 70 lb.	19	23	44½	33	...	27	52
*M 7, 91 lb.	20½	...	53½	29½	...	31	51
*M 3, 98 lb.	25	27	46½	...	...	...	53½
Unmanured	20	14½	40½	33¾	16	26¾	51
Superphosphate, 140 lb.	...	...	...	35½	...	...	...
*M 12, 130 lb.	...	...	...	...	24½	...	...
Blood and bone, 140 lb.	...	...	...	...	...	31¾	...
Special proprietary, 100 lb.	...	...	...	...	...	29¼	...
Special proprietary and blood and bone in equal parts, 140 lb.	...	...	...	...	...	33½	...

* M 3 consists of superphosphate 10 parts, sulphate of ammonia 3 parts; M 7 of superphosphate 10 parts, chloride of potash 3 parts; M 12 of superphosphate 10 parts, sulphate of ammonia 4 parts, chloride of potash 3 parts.

† On better quality, more sloping and better drained land.

Yanco Irrigation Area.

A. N. SHEPHERD, Senior Agricultural Instructor.

Sowings of maize were made in co-operation with the Department during the past season by the following farmers:—

Messrs. Briggs, Farm 816, Leeton.
R. Farrer, Farm 798, Leeton.
J. Morphett, Farm 865, Stanbridge.
P. A. R. Gersback, Farm 864, Stanbridge.

Two variety trials were conducted, in which several varieties new to the Area gave promise of being worthy of further tests. Two plots of pure seed of Iowa Silvermine were also grown. This is a variety that has done exceptionally well on the Area, and one that is eagerly sought after by those who grow maize for grain. The plots were grown specially to supply this demand for pure seed.

The season was very much against the growing of maize for grain. Extreme temperatures were recorded, from 45 degrees Fah. at the end of December to 110 degrees Fah. in February. Absence of rain was also very marked, only 30 points being registered during the growing period. Strong, hot winds were also experienced.

The Plots.

Farm 816.—A variety trial was sown on this farm on red loam. Barley (with 56 lb. superphosphate) had been grown on the land previously. Seed was sown on 15th December with the wheat drill in rows 35 inches apart at the rate of 12 lb. per acre, a dressing of superphosphate being applied at the rate of 70 lb. per acre. With the exception of Wellingrove and Early Morn, a good germination resulted, and the plants made rapid growth. Golden Glow and Early Morn tasselled in the last week in January. The crop was irrigated in January, twice in February and March. It was picked in April.

Some very nice samples of maize were obtained, the cobs filling well despite the unfavourable weather conditions. Golden Superb gave the heaviest yield, and promises to be a variety suitable to the district. The low yields of Wellingrove and Early Morn are accounted for by the thin stand. The results were as follows:—

	bus. lb.		bus. lb.
Golden Superb ...	57 14	Golden Glow ...	45 28
Iowa Silvermine ...	53 0	Wellingrove ...	38 0
Funk's Yellow Dent ..	52 0	Early Morn ...	35 0

Farm 798.—Four varieties were sown on heavy grey soil on 18th December. Part of this land was inclined to be "puffy." It was ploughed in October, the previous crop being oats two seasons ago.

Furrows were run out 3 feet apart, and the seed was dropped by hand at the rate of 12 lb. per acre, superphosphate being applied with the wheat drill at the rate of 70 lb. per acre. Splendid germination was obtained, but

many of the young plants died off on the "puffs." This was due to very rapid growth in the early stages and to the puffs then drying out before irrigation. It might also be mentioned that the seed on the puffs was the first to germinate.

The crop received its first watering on 16th January, and was irrigated again on 8th February and at the beginning and end of March. All the varieties grew very well, and some good samples of maize were obtained. The yields were as follows:—

	bus. lb.		bus. lb.
Iowa Silvermine ...	58 28	Kennedy	46 14
Eureka	54 18	Funk's Yellow Dent	46 0

Farm 865.—A stud plot of Iowa Silvermine was sown on a red sandy loam, comprising the better class land of the area, on 14th December. The seed was hand-dropped, and the fertiliser (70 lb. per acre) was placed in the furrow. The land was in splendid condition at sowing time, and very good germination was obtained. After each irrigation—five waterings were given in all—the land between the rows was cultivated. The crop was harvested in May and gave the satisfactory yield of 60 bushels per acre.

Farm 864.—As on the farm adjoining, Iowa Silvermine was sown as a stud plot. The soil consisted of a red sandy loam that had been fallowed since October. The seed was dropped by hand in rows 3 feet apart, and superphosphate added at the rate of 70 lb. per acre. This plot germinated very quickly, and made very rapid growth; in fact on 30th January, when it received its second watering, the crop was 3 feet high. The yield (30 bushels) was very disappointing, the cobs being on the small side, but the grain was of good quality.

Need for Research in Agricultural Economics.

There is one kind of research which is only now receiving some attention for the first time From this research, I, for one, anticipate immense benefits to agriculture. It is the investigation of the economics of agriculture. Almost every other industry is in the habit of using, and in fact in order to succeed, must use statistics of many descriptions. . . . . . No modern business can succeed without a costing system. It is more difficult to cost farming than it is to cost an ordinary commercial business, but the difficulty is not insuperable, and the profits therefrom are very great. Dr. Ruston, of Leeds, has recently shown the results from costing 52 farms in Yorkshire. He found last year that 38 per cent. of these farms left a profit, and in some cases a large profit (as much as £10 per acre in one case), but that the profits and losses varied as much as £20 per acre, *i.e.*, £10 loss and £10 profit. . . . . . It is of the utmost importance to the country as a whole and to agriculture that we should learn what systems of management and of farming are so profitable or so unsuccessful.—Extract from an address by Sir Robert Greig, Chairman of the Scottish Board of Agriculture.

Cotton-growing under Irrigation.

A. N. SHEPHERD, Senior Agricultural Instructor.

Cotton has been grown in small plots for quite a number of years on the Murrumbidgee Irrigation Areas, some of the early settlers from America having brought seed with them. The crop has not so far been grown profitably on a commercial scale, however, and it is advisable that its cultivation be limited to small experiment areas for the present. Trials to date clearly indicate that cotton is a crop for the better-class soils—that is, the class of land a settler would be inclined to sow to lucerne, maize, or potatoes On the heavy land cotton makes very little growth, and germination is hard to obtain.

Both the chocolate and sandy loams lend themselves to cotton culture. With these classes of land the preparation of the seed-bed is much easier, and, owing to the greater moisture-holding capacity, germination of the seed is more certain. Less irrigation and cultivation are necessary, and a much heavier return of cotton is obtained, while harvesting is much easier and less costly, there being a greater number of bolls, with fibre of better and more uniform quality.

Preparation of the Land.

In preparing land for cotton, the same care must be exercised as for lucerne, although one need not be so accurate, for while lucerne is usually flood-irrigated, cotton is furrow-watered.

After the land has been well ploughed—a depth of about 6 inches being advisable—and worked down, the grader should be run over the land to remove any high bumps and fill any hollows. This grading is necessary to ensure even and quick watering, otherwise water may lie in some parts, while other portions remain dry. If irrigation is uneven, the plants make patchy growth, and mature at different periods, and the cotton is not of uniform grade, its value being lowered, and its harvesting made much more expensive.

After being graded, the land should be worked up and allowed to lie fallow until time to prepare for sowing.

It is advisable to make this initial preparation in the autumn previous to seeding. If the whole of the work is left until later, trouble may be experienced in the preparation, as grading wet land is not satisfactory. Autumn preparation also enables the soil to sweeten up during the winter, thus giving the cotton every chance when sown.

Sowing the Seed.

It is essential that the land receive a thorough irrigation previous to sowing, saturating the subsoil so as to have available a plentiful supply of moisture for the young plants. After this irrigation only a shallow cultivation should be given—not more than 2 inches at most. This is necessary, so that as much moisture can be retained in the soil as possible, and so that a firm bed, close to the surface, is available for the seed. Thus the seed can be sown in a firm, well-packed seed-bed, conducive to good germination. If the soil is loose, it has a tendency to dry out before the roots of the young plants have become firmly established in the soil, with proportionate loss.

It cannot be too strongly urged that a thoroughly well-prepared seed-bed is imperative to produce a good stand of cotton. Sowing should be carried out directly after the cultivation following on watering.

Sowing should be carried out as soon as danger of frost is over and the soil has warmed. This is usually the end of September, or, at latest, the middle of October.

Varieties.

The only seed available in any quantity is the Upland variety, which has been grown in Queensland for some years.

Experiments have been conducted on the areas with the Pima variety, but the results so far have not been satisfactory. It is too long in reaching maturity, and, moreover, it is costly to pick, owing to the smallness of the bolls.

Preparation of the Seed for Sowing.

The cotton seed is more or less covered with fluff, or short cotton, and if a cotton-planter is not available, some treatment is necessary before it can be sown with a machine. The following methods have been found fairly satisfactory in the preparation of seed for sowing:—(1) Treating with sand; (2) treating with a thin flour paste; (3) treating with sulphuric acid.

In the first-mentioned method the seed is spread out on a bag or board; water is applied, sand is spread over the wet seed, and is rubbed with the hand with a circular motion. This operation separates the seeds from one another, and causes the fluff to adhere closely to the seed surfaces. The seed is then spread out to dry, and subsequently sieved to remove any loose particles of sand. About 15 minutes in the sun will be sufficient for drying. After being sieved, the seed is ready to be sown.

In the second process the seed is dipped in a thin solution of flour paste (squeezed in the hand to remove excess liquid), spread, out, and given a light rubbing with the hand, as in the sand treatment. It is then allowed to dry, care being taken not to allow the seed to stick together.

In the third method the seed is stirred in strong sulphuric acid for five to ten minutes, and then rinsed thoroughly in water, and dried. The acid can be used for treating several lots of seed. Care must be exercised with it, as it burns both clothes and flesh very readily.

Rate of Seeding.

Sowing should be at the rate of 15 to 25 lb. of seed per acre. On the better-class land, where germination is more certain, and the plants make better growth, the lesser quantity will be sufficient. Heavy seeding provides more plants to break through any crust that may form on the surface. It also affords more choice when thinning out the plants, and thus ensures a better stand.

Method of Sowing.

On a small plot sowing may be carried out by hand, but on a larger scale the maize- or cotton-planter is a useful implement. When the maize-planter is employed, thick plates should be used, so as to allow six to eight seeds to be sown at once, the greater number of plants having a proportionately better chance of breaking through any crust that may have formed. The covering wheel of the maize-dropper compresses the soil on the seed, encouraging quick germination. The machine should be set to drop each lot of seeds 10 to 16 inches apart, but this distance can be regulated by the use of different sprocket wheels. The depth of seeding will depend on the class of soil, but care should be exercised to put the seed in damp soil. It is usual to sow 1½ inches to 2 inches deep, but plant rather at 2½ inches if extra moisture is to be gained. This applies more to the lighter, sandy soils.

Various devices are employed to ensure sowing in damp soils, more especially where the surface is dry and cloddy. But where irrigation water is available these are not necessary, and it is preferable to take a few days longer to prepare an ideal seed-bed than to introduce novelties to overcome the neglect.

The rows should be sown 3 feet 6 inches to 4 feet apart, the latter being the better spacing in the better soils, for they produce more vigorous plants, and therefore require more space.

Thinning.

Thinning is an initial operation. The object is to give each plant sufficient room to develop into a healthy, strong individual. In some cases it is done by hoeing out the surplus plants, but much more satisfaction is obtained if the plants are pulled out by hand. A much better selection can then be made, the weaker and inferior plants being eliminated. Thinning should be carried out when the plants are from 3 to 5 inches high; and, according to the quality of the soil, the plants should be spaced from 10 to 16 inches apart.

Cultivation and Irrigation.

Cultivation is necessary as soon as possible after the young plants appear, in order to conserve moisture and keep down weed growth. For this purpose either the two-horse cultivator or the single-horse scuffler may be used. When the plants have attained a fair height, they can be slightly hilled, or the soil worked toward the plants. This also helps to keep the water from flooding the plants. Furrows should be put in between the rows so as to assist in watering. This can be done at the same time as the crop is

being cultivated by attaching a "broad shovel" to the cultivator in place of the narrow tine. The two operations are then carried out at the one time. It is advisable to cultivate after each irrigation until the operation is liable to damage the plants.

No hard and fast rule can be laid down as to when to water and the amount required. So much depends on soil and weather conditions. The grower must keep sufficient moisture in his soil for plant requirements, but at first irrigation should be delayed as long as possible, for light watering tends to encourage the setting of the bolls. The condition of the plants must be the guide; irrigation is not required as long as the plants are in a growing condition.

Prior to flowering give as little water as possible, forcing the roots to penetrate deep for the moisture stored in the soil before sowing. After the bolls begin to form it is essential to maintain a thrifty and uniform, though not rank, growth. Care should be taken after flowering not to allow the plants to wilt. If the plants suffer for want of water the crop is likely to be affected both in yield and quality of fibre; and owing to the bolls not opening well and regularly, picking will be more difficult.

If a large amount of water is suddenly supplied, following a period in which the plant has been suffering for want of moisture, a quick stimulation of growth will be caused, resulting in the plants dropping many of the young bolls already set.

Picking.

This operation entails going over the crop two or three times before the gathering of the crop is complete. Care should be taken to keep the fibre as free as possible from dirt, leaves, sticks, or other trash, as these foreign substances greatly reduce prices.

Each picking should be kept by itself, to allow of more even grading. Wet cotton should not be picked, but if it is only slightly damp picking need not stop provided the cotton is spread out to dry before being bagged. Do not mix different varieties of cotton, as this considerably reduces the value of the consignment.

Picking in the Murrumbidgee Irrigation Area commenced last year on 18th March.

Cotton as an Inter-planted Crop.

Cotton can be used as a crop to sow between the trees of young orchards, about three to four rows being sown between each two rows of trees. By sowing only that number, cultivation of the fruit trees is not interfered with, and irrigation of the trees may be carried out without affecting the cotton.

Ratooning.

The much-condemned practice of ratooning—allowing cotton plants to become perennial—has not been followed on these areas, nor should it be encouraged. Apart from the reduced yields of inferior fibre, there is the danger of pests, a risk that should have every consideration.

Top-dressing of Lucerne with Superphosphate.

FIELD EXPERIMENTS AT YANCO EXPERIMENT FARM.

R. G. DOWNING, B.Sc. Agr., Senior Experimentalist.

FURTHER experiments were carried out with lucerne under irrigation at Yanco Experiment Farm recently, with the object of ascertaining—

1. The profitableness or otherwise of applying superphosphate as a top-dressing.
2. The most profitable rate at which to apply it.
3. The most suitable period of the year to make the application.
4. The residual effect of applications of superphosphate at the rates of 1 cwt. and 2 cwt. per acre.

The trial has now been carried on for four years. Results obtained in the first season were published in the *Agricultural Gazette* of October, 1920 (p. 699), and the yields obtained in subsequent years confirm the conclusions which were then tentatively arrived at.

On account of local soil variation in the site of this experiment, together with occasional shallow depressions which render irrigation uneven, several irregularities have from time to time occurred in the results. For this reason they are not published in detail, but the increased yields obtained over the whole period from the top-dressed plots, together with the very noticeably vigorous growth of the fertilised compared with the unfertilised plots, quite conclusively recommend the practice as part of a sound system of lucerne culture on the Murrumbidgee Irrigation Areas.

Conclusions.

The results from the trial may be summarised as follows:—

1. The practice of top-dressing lucerne is undoubtedly a profitable one. Both rates tested (1 cwt. and 2 cwt. per acre) leave a wide margin of profit after allowing for the cost of the fertiliser and of its application.

2. The most profitable rate to use is 2 cwt. per acre. Over the four years of the test the average increase (on an average total yield of approximately 3 tons per acre for the unmanured plots) has been approximately 1 ton 10 cwt. per acre of hay. Taking the average value of lucerne hay for the four years as £6 per ton—which is approximately the average of prices actually obtained on the Sydney market for the period—superphosphate at 6s. 6d. per cwt. at Yanco, and cost of application of the fertiliser at 3s. 2d. per acre, this represents an increased return of slightly more than £8 per acre.

3. The early spring top-dressing gives slightly better results than the autumn application.

4. The effects of a top-dressing of 1 cwt. or 2 cwt of superphosphate per acre are still apparent four years after the application. This residual effect is noticeable in the case of each of the four plots which were treated in the first year of the experiment only, that treated with 2 cwt. per acre in early spring (which proved the most effective) showing a total increased yield over the period of approximately 4 tons.

Similar results have been obtained from trials carried on in other parts of the State, particulars of which have already been published in these pages. In a few isolated localities (usually on rich alluvial soils) the response from top-dressing with superphosphate has been negative, so that it would be advisable for a farmer, if the treatment has not been tried in his district, to carry out a simple test, leaving unmanured strips of several drill-widths to compare with similar areas of top-dressed crop. The produce from these need not necessarily be weighed. Observation of the growing crop, together with a rough estimation of the comparative amounts of hay from the different strips when raking, should serve to show whether an increase commensurate with the cost of the fertiliser and its application has been obtained.

Another advantage of top-dressing lucerne is the increased vigour of the treated stand. This results in a finer and more leafy growth, giving a hay of superior quality and more free from weed growth than an unfertilised crop. No account has been taken of this in the above calculations, but it certainly means a considerable increase in the price obtained on the market for lucerne hay so produced.

The Influence of Herd-testing.

The influence of herd-testing is frequently very manifest during the second testing season for the herd. For example, among the herd-testing associations whose computations were made at the headquarters of the Dairy Division during 1920–21 and 1921–22 there were some 218 herds which were tested in both these seasons. The yield of the average cow in these herds increased from 213 lb. to 253 lb. of butter-fat, or about 19 per cent. Even granting that some portion of this increase may have been due to the fact that 1921–22 was a better season for grass, much of the improvement is undoubtedly due to knowledge gained as the result of the previous season's testing. In these herds the number of cows tested each season was very similar. Our figures show that often dairy-farmers reduce their herds as the result of testing, and still maintain the total yield of the herd. We also have data which show that in certain cases during a second testing season, with only two-thirds of the previous season's herd, the total butter-fat produced underwent no reduction, while one dairy-farmer during his first testing year milked twenty-three cows to produce as much butter-fat as did sixteen which he milked two seasons later.

Instances which bear out the same principle could be multiplied.—W. M. Singleton, Director of the Dairy Division, in the New Zealand *Journal of Agriculture*.

Farmers' Experiment Plots.

POTATO EXPERIMENTS, 1922-23.

Central-western District.

W. D. KERLE, Senior Agricultural Instructor.

POTATO experiments were planted at six centres in the central-west during the 1922-23 season, but results were obtained from four only, and these, owing to drought and insect attack, were much below the average. The plots belonged to the following farmers :—

G. W. Kelly, Caves-road, Oberon.
A. W. Perry, "Birrima," Tarana.
Wm. Burns, "Goongirwarrie," Carcoar.
E. A. de Lautour, "Hillview," Springside, Orange.

The twelve months that preceded the termination of the drought on 3rd June, 1923, will long be remembered in the central-western districts as one of the most disastrous periods ever experienced for the production of crops. In that time only two decent falls of rain were recorded, namely, in June and December, 1922. The former beguiled the wheat-grower into eleventh-hour sowing of his crop, while the latter gave the potato-grower false hopes of good yields. In both instances the subsequent months of growth were practically devoid of useful rain, and abnormally low yields were obtained. Unfortunately this was not the only disability with which the potato-grower had to contend. The potato moth was very active throughout the potato-growing centres of the central-west, particularly in early-sown crops, and was responsible for reducing the already low yields a further 30 to 50 per cent.

The accompanying table shows the rainfall recorded at four centres—conclusive evidence of the unsatisfactory nature of the season :—

Month.	Oberon. (Sown 23rd Dec.)	Tarana. (Sown 28th and 29th Nov.)	Carcoar. (Sown 17th Nov.)	Orange. (Sown 16th Nov.)
1922.	points.	points.	points.	points.
November...	......	......	......	17
December	395	362	344	423
1923.				
January	77	98	70	59
February	......	......	......	......
March	147	94	128	132
April	......	......	......	......
Total	619	554	542	631

Cultural Details.

Oberon.—Soil, a grey, clay, slaty loam, typical of much of the potato soil of the locality; site previously cultivated for many years, usually on a two-course rotation of peas and potatoes, though occasionally a cereal crop is introduced. The 1921–22 pea crop was off in May, 1922, and the land was left untouched until August, when it was mouldboard ploughed and harrowed. No other cultivation was given. The seed was ploughed in 2 ft. 6 in. apart on 23rd December.

The season here was slightly more favourable than at the other centres, and the later sowing was an advantage, the crop suffering very little from potato-moth attack. The growth of haulm was not great, except in the case of Dakota Red, from which the yield was light. The germination of Teasdale and Red Ruby was very poor, particularly the former variety, the percentage of which was not more than 33⅓. In view of the meagre rainfall the quality of the potatoes in this experiment was surprising. Practically no grading was necessary for market. Teasdale, which at all other centres was small and yielded very low, was of excellent size and shape at Oberon, and promises well in the locality. It is a white-skinned variety. Redsnooth is a deep red coloured variety, with oblong flattened tubers, smooth-skinned and shallow-eyed.

Tarana.—Soil, grey, sandy loam; virgin land, cleared and ploughed once with mouldboard plough in winter 1922. Machine planted on 28th and 29th November, in rows 2 ft. 9 in. apart; whole sets employed with the exception of Up-to-date and Carman No. 1, which were halved. The variety trial was not fertilised. The varieties germinated satisfactorily, but did not make much top-growth. Moth was practically absent in this locality, but a heavy frost in February helped to reduce the yields. The rainfall was quite inadequate, particularly for the type of soil on which the experiment was conducted. Up-to-date, which was grown from selected seed, was easily the best in point of yield. The return from the new variety, Symington, was surprising, and particularly the large size of some of the tubers.

Carcoar.—Soil, grey, slaty loam, typical of locality; previous crop, winter fodders. Ploughed 21st September; spring-tooth cultivated 20th October; planted 17th November, and harrowed on 18th; superphosphate used with variety trial at the rate of 2 cwt. per acre. Harvested 21st to 24th May. Rainfall lowest of all centres, and moth attack particularly severe.

Springside.—Soil, basaltic chocolate loam, typical of the potato soil of the district; previous crop, oats, cut for hay December, 1921. Disc ploughed 8 inches deep, July, 1922; harrowed and spring-toothed, September; re-ploughed October, and planted 15th November, 1922. Rows 3 feet apart, sets 15 to 18 inches apart in rows. Superphosphate applied at sowing time at the rate of 2½ cwt. per acre. Soil in a slightly moist, friable condition, and harrowed immediately after planting. Germination not uniform, and bad in Red Ruby and Teasdale. Growth of haulm light, except of Symington

and Dakota Red. The season was particularly severe here, the January fall being light and of practically no value. Lack of available moisture, severe moth attack, and early frost were responsible for yields, which for this centre were particularly low in comparison with normal times. It is interesting to note the drought resistance of Factor, although the tubers were not of large size.

RESULTS of Variety Trials, 1922–23.

	Oberon.	Tarana.	Carcoar.	Springside.
Date Harvested ...	24th–27th July.	14th–18th May.	21st–22nd May.	23rd–24th July.
—	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Factor	2 13 1 20	......	2 7 3 14	1 6 1 5
Late Manhattan	2 10 1 4	0 12 0 19	......	0 12 1 12
Redsnooth	2 11 2 5	0 14 1 24	1 11 1 7	......
Early Manhattan	......	0 12 0 6	1 11 2 0	......
Batlow X	1 5 2 4	0 13 1 10	1 10 1 16	......
Symington	......	1 5 2 24	0 14 3 0	0 15 1 2
Up-to-date	......	1 8 1 22	......	......
Early Manistee	2 9 2 0	......	......	......
Teesdale	1 4 3 0	0 13 3 26	1 7 2 14	0 10 2 0
Dakota Red	1 15 3 0	0 9 0 12	0 11 3 25	0 8 3 0
Red Ruby	2 6 0 0	0 11 2 2	......	0 7 2 0
Early Rose	2 6 3 0	0 8 3 0	......	......
Satisfaction	......	0 15 2 10	......	......
Carman No. 1	......	0 17 1 12	......	......
Queen of the Valley	......	0 15 1 0	......	......

Manurial Trials.

Although manurial trials were conducted at three centres, results are obtainable from one only. At Tarana Up-to-date was sown in a trial with five fertiliser mixtures, and although a yield of 1 ton 8 cwt. was obtained from the unmanured plot, the manured plots were a failure.

The results at Oberon, together with those for the season 1921–22 (not hitherto published), are shown in the following table:—

RESULTS of Fertiliser Trials at Oberon.

Fertiliser per acre.	1921–22. (Sown 16th Dec.)	1922–23. (Sown 23rd Dec.)
	t. c. q. lb.	t. c q. lb.
P9, 4 cwt. ...	3 18 1 26	2 1 3 21
Superphosphate, 2½ cwt. ...	3 7 3·12	2 6 3 0
Superphosphate, 5 cwt. ...	3 6 0 8	2 4 2 21
M7, 3½ cwt. ...	3 5 2 6	1 17 1 18
No manure ...	2 14 2 6	1 18 2 0

In both seasons the variety tried was Early Rose.

P9 mixture consists of superphosphate 10 parts, chloride of potash 3 parts, sulphate of ammonia 3 parts; M7, of superphosphate 10 parts, chloride of potash 3 parts.

The most economical fertiliser to apply at this centre is superphosphate at the rate of 2½ cwt. per acre. P9 is a complete fertiliser, costing considerably more than superphosphate, and it would not be so economical in the long run. It is interesting to note that a heavy application of superphosphate is not so efficacious as the medium one of 2½ cwt.

Comments.

In a season so far from normal, and where yields are so very low, it may be considered inopportune to draw comparisons between varieties. It affords an indication, however, of the drought-resisting qualities of varieties, a factor which is of considerable importance. In this connection the behaviour of Factor (and of Up-to-Date, which it closely resembles) is noteworthy. At all centres it had a substantial lead in yield, and although the tubers were not so large on the average as some other varieties, this can hardly be considered a detriment in the districts under review, which cater extensively for the seed trade.

Of the new varieties, Redsnooth and Symington were outstanding; particularly the former, which, apart from its high-yielding capacity, cannot fail to be popular, because of its colour, shape, shallowness of eyes, and cooking qualities.

The depredations of the potato moth (*Lita solanella*) this season call for greater activity on the part of the potato-grower. It is unfortunately becoming more prevalent, and its presence in the field and in store results in a very considerable loss annually.

The following points are advanced in connection with its control:—

(1) Tubers left in the field from the preceding harvest provide the surest means of carrying the pest over from season to season. Care should be taken, therefore, to leave nothing on the ground when harvesting.

(2) The haulms from an infested crop should be destroyed as soon as possible, and under no circumstances should tops be used for covering the mouths of the filled and unsewn bags when harvesting.

(3) Careful cultivating and hilling is one of the surest control measures. Aim to keep the tubers well covered with fine soil while growing to prevent the ingress of the moth.

(4) Deeper planting of the seed than is usually practised is advisable, particularly where hilling is not done.

(5) When harvesting, bag the tubers with as little delay as possible, sew up the bag at once, and remove as soon as convenient to the barn.

(6) Remember that much of the damage done by the moth is to potatoes in storage, and keep a constant watch on these.

THE total value of agricultural machinery and implements in use on agricultural holdings (in this State) has risen as follows:—1900-01, £2,065,780; 1910-11, £3,414,620; 1921-22, £7,884,710.—*Official Year Book of New South Wales.*

Pleuro-pneumonia Contagiosa of Bovines.

THE POSSIBILITY OF MORE EFFECTUAL CONTROL WITH A VIEW TO ERADICATION.

MAX HENRY, M.R.C.V.S., B.V.Sc., Government Veterinary Surgeon.

IN the June issue of the *Gazette* was published an article entitled, "The Control of Infectious Stock Diseases in New South Wales." The article dealt in a very general manner with the methods at present in force for combating the various animal plagues from which our live stock suffer, and gave some slight indication of possible lines of action which might be adopted in the future. Among the diseases briefly mentioned was pleuro-pneumonia contagiosa of bovines, and it is proposed in this article to consider the possibility of that disease being more effectually controlled, with a view to its ultimate eradication.

It is, of course, no new thing to suggest that any particular disease should be once and for all abolished within a definite area, whether that area be county, state, or country. The suggestion has many times been carried out with success, as, for example, in the cases of scab in Australia and New Zealand; rinderpest in Great Britain, Belgium, and many provinces in South Africa; glanders in the British armies of the great war; and rabies in Great Britain, Denmark, Sweden, and Norway. The reasons which may lead to the clearing of a country from any given disease vary considerably. It may be that it catches the popular imagination, and pressure of public opinion forces the authorities to act; danger to the public health or economic loss may have the same result. In other instances, the circumstances surrounding the incidence of the complaint, or some peculiarity in methods of animal husbandry, render it a comparatively simple matter to bring about the desired condition. Not infrequently a combination of the above reasons is operative, and supplies the necessary driving force.

In considering the question under review, the above points must be given due weight, but first it would appear necessary to consider whether the objects sought have been attained in any other country. Pleuro-pneumonia contagiosa was almost world-wide, occurring in nearly every country in which cattle were reared, but it has been eradicated in the following lands, the dates in brackets giving the year of the last outbreak:—Belgium (1897), France (1906), Great Britain (1898), Holland (1887), Denmark (1856), Norway, Sweden, United States of America (1892). It is doubtful if Canada was ever affected; if so, she has now been clear of the disease for many years. Turning to countries nearer home, it should be noted that New Zealand and Tasmania are, and always have been, free from the disease. Evidently, then, under certain circumstances, and by certain

methods of animal husbandry, pleuro-pneumonia contagiosa can be not only controlled, but eradicated. It is of interest to observe the conditions existing in some of those countries which have dealt effectively with pleuro-pneumonia, and to note to what extent similar action might be possible here.

American Experience.

In the annual report of the Department of Agriculture of the United States of America for 1886, the following passages occur:—

"The Bureau of Animal Industry.—The most important work of this bureau has been the investigation and control of the contagious diseases of animals. . . . Most important at this time is the contagious pleuro-pneumonia of cattle, which, introduced into our Atlantic seaboard states nearly half a century ago, has until recently been kept away from the great central markets of the country. About three years ago the contagion of this disease was carried to Ohio, from Ohio to Illinois, and from Illinois to Kentucky and Missouri. After a continued application of all the authority granted under the national and state laws, the plague was extirpated from Ohio, Missouri, and Kentucky, and it was thought to be also eradicated from Illinois. Unfortunately, it was again found to be in existence in and around Chicago in September last. . . . Every effort possible under existing laws has been made to locate the diseased animals and isolate all that have been exposed . . . it would have been most fortunate if every animal exposed to the disease, and liable to contract it, could have been summarily slaughtered, and the contagion thus eradicated. The experience of all countries has been that the malady may be thoroughly and completely stamped out in this way, and that there is no other means by which the bovine species can be protected from its ravages."

The position in the various infected states is then dealt with seriatim. Kentucky, for instance, applied for the release of quarantine restrictions, as it was considered the disease had been extirpated. Evidently the other states had regarded the question seriously, and refused to accept any bovines from Kentucky except under "rigid and burdensome restrictions." The loss to the state had been heavy, and it is urged that this might have been entirely avoided "if there had been authority for this Department to cause the prompt destruction of the infected herds when the plague was first discovered."

The Federal Government had drawn up a series of regulations aiming at co-operation between the State and the Federal authorities. These rules dealt with (*a*) inspection; (*b*) quarantine, the minimum period being set at ninety days from the removal of the last diseased animal, all infected herds to be held in quarantine when possible and not allowed to leave infected premises except for slaughter; (*c*) slaughter of infected animals and compensation on an improved basis; (*d*) disinfection; and (*e*) inoculation, which, while not recommended, could be practised in quarantined herds. The report for 1888 shows that the disease had been eradicated from all the western states, and Maryland had been very nearly cleared. In

some of the eastern states the disease was still prevalent, but more and more stringent legislation was being obtained and more funds provided to cope with the disease. One feature of this work is often stressed in this report, namely, the eagerness of the "native American farmer" to assist in eradication.

What Great Britain Has Done.

The annual report of the Chief Veterinary Officer, Department of Agriculture, Great Britain, for the year 1898, contains a brief review of the history of cattle plague, foot and mouth disease, and pleuro-pneumonia. This review commences as follows:—

"As a result of the measures taken in connection with the final eradication of pleuro-pneumonia, which for the last two years had been centred in the cow-sheds within and around the metropolis, Great Britain is at the present time entirely free from the contagious diseases affecting cattle which during the last sixty years have caused so considerable a loss to stock-owners and incidentally to the public."

Since that time Great Britain has been free from the disease. It appears that about 1840 the disease found its way into England from Ireland, and slowly spread throughout the country. Very little notice was taken of its occurrence, and no legislation gave power to the authorities to combat it. In 1865, however, cattle plague also appeared in England from Russia, and so terrible were its ravages that legislation had to be introduced to save the herds by control. At the same time action was commenced against pleuro-pneumonia.

The Contagious Diseases (Animals) Act, 1878, gave considerable power to the authorities to control pleuro-pneumonia, the responsibility being in the first place vested in the local authorities. It was made compulsory on the local authority to cause all cattle affected with pleuro-pneumonia to be slaughtered within two days after the existence of the disease was known to them. The local authority also had power, if it thought fit, to slaughter "in-contact" cattle. Compensation was provided for.

Very little advance was made in the control of the disease under this Act, however, because the good work of one local authority would be nullified by the neglect of the neighbouring ones. In 1890 a fresh act was passed, placing the whole control under the Board of Agriculture. At that time pleuro-pneumonia existed in thirty-six counties, and fresh outbreaks were being reported at the rate of ten per week. So rapidly did the work proceed that in 1898 there were only nine outbreaks, and the last case seen in England occurred in 1898. This work was accomplished through the slaughter of affected and in-contact animals.

It is interesting to note that in 1895 a shipload of cattle from Sydney was landed at Deptford for slaughter, and among them were found, on post-mortem, twelve cases of pleuro-pneumonia.

It is therefore very evident that, providing sufficiently drastic action is taken, pleuro-pneumonia can be eradicated under the conditions obtaining thirty and forty years ago in Great Britain and the United States. Every

country which has similarly dealt with the disease has done so by virtue of the state of affairs therein existent. That is to say, they were countries which were thickly populated, where farms were small, and herds only comprised a few animals. These animals, moreover, were under daily supervision, and could be dealt with individually.

The Position in Australia.

In Australia these conditions do not yet wholly obtain, though in parts of the continent (and some of those parts most seriously affected) conditions are beginning to approximate to those of Europe. Unfortunately, so far as this question is concerned, the country is in so many different stages of development that uniform action is more than can be looked for.

Queensland, with her wide, open spaces, large herds, and great distances, must find very great difficulties in attempting effectively to control such a disease; New South Wales is rather more fortunately situated, and Victoria still more so. It follows that effective control will come gradually from the south northwards. As a result of further activities in the south, the tendency to place still more restrictions on the movements of cattle from the north will increase. The more rapid the settlement of the southern states, the more active will be the demand for such restrictions. This tendency will be an inevitable phase in our development, and will meet with very considerable opposition, but it must eventually overcome that opposition and create such a situation that the demand for the eradication of the disease will automatically arise. It is not at present useful to outline methods of eradication for Australia, but it is both useful and desirable so to direct our efforts at control that they shall tend to bring about a state of affairs in which it will be practicable to consider the further and ultimate step.

Already there are in New South Wales areas of considerable size from which pleuro-pneumonia has been banished for many years, and so long as present conditions and tendencies prevail the disease will not be seen in those areas again. One such example is to be found in the tick quarantine areas. Into these areas very few cattle (except stud and valuable dairy stock, and those only New South Wales bred) enter, except for immediate slaughter, and consequently the risk of the introduction of disease is brought to a minimum. A similar state of affairs holds good for the far South Coast. In the Central Division are other large areas out of the line of drift of travelling stock where the disease is now practically unknown.

Is it Worth While?

In considering a problem of this nature, one point will certainly be raised—Is it worth while? To answer this question, one has only to enumerate the disabilities which the disease inflicts on our live-stock interests. These are:—

1. The actual loss of animals by death from pleuro-pneumonia—not a great number in the aggregate, but crippling in individual cases.
2. The cost, inconvenience, and possible loss involved in inoculation.

3. Restrictions of movement, with at times the loss of a good market.
4. Interference with the supply of milk from individual dairies.
5. The embargo laid on our cattle by Tasmania, New Zealand, and the United States.
6. The restriction of movement of cattle into Victoria.
7. The embargo placed on our sheep by the United States.
8. The difficulties which the disease places in the way of traffic in cattle with Java, the Philippines, &c.
9. The constant danger to our healthy herds.

It has been mentioned that strict control would gradually extend from the south. The methods adopted will, of course, be devised to meet the various sources of danger. One of these dangers, and that least realised, is the existence of what may be termed the "carrier." These carriers are animals which have suffered from an attack of pleuro-pneumonia and recovered, but have retained a chronic lesion in the lung. Under the influence of exertion, climatic change, &c., this lesion again becomes active, and the affected animal becomes a positive instead of a merely potential source of danger. It is likely, then, that the first step will be to prevent the creation of carriers by slaughtering all affected animals. Unfortunately, it is not as easy as may be thought to decide what animals are affected, particularly in the case of dairy stock, and, with the destruction of affected animals, therefore, there will logically be brought into effect more thorough steps to determine what beasts are actually affected. These methods will include closer clinical observations, and also serological tests.

The result of these efforts would be the cleaning up of many of the almost chronically affected herds which exist in parts of Australia. Once having made them clean, it would be folly to allow them again to become infected. To prevent this, the period of quarantine would require to be lengthened, and if that quarantine were extended until every beast in the herd had been sent off for slaughter, the results from an eradication viewpoint would undoubtedly be most marked. In any event considerable restriction on the freedom of movement of herds which had been quarantined would be necessary, and that restriction would probably involve prohibition of movement into areas known to be clean.

Control of movements of live stock play a big part in the control of disease, particularly with such a disease as pleuro-pneumonia, as it is so often necessary to trace back affected mobs to their origin. The present system of permits in vogue under the Pastures Protection Act is of great help in this regard, and the Departmental system of notification of the movements of quarantined cattle after release is of further assistance.

One of the chief difficulties met with in such work as is reviewed here is the delay which so frequently occurs in the notification of the disease. To obtain early advice of outbreaks the co-operation of all officials dealing with live stock is required. Inspectors of meat in abattoirs and slaughter-houses are often in a position to give early information to the authorities controlling disease in live stock, as not infrequently animals chronically affected

find their way to the abattoirs. If the detection of these animals is followed up, an outbreak may be nipped in the bud, or if the new tests are confirmed and used, outbreaks may actually be prevented.

It is thus evident that there are many possibilities in the way of future control of pleuro-pneumonia, and when the time comes, through the advance of development and closer settlement, to put the campaign against this disease more completely into operation, the means will be ready to our hands. It is unfortunate that one cannot say the same of all diseases.

The World's Wheat Yield Compared.

The yield of wheat in New South Wales does not compare favourably with the yields usually obtained abroad in some of the large wheat-producing countries. Smaller producing countries, particularly those situated in the colder climates, show far greater average yields. Representative averages in recent years are shown below:—

Country.	Period.	Average Yield per acre.	Country.	Period.	Average Yield per acre.
		bus.			bus.
United Kingdom ..	1914-1920	31·6	New South Wales ...	1912-1921	11·6
New Zealand	1914-1920	26·1	Australia	1912-1920	11·2
Canada	1914-1920	15·4	Russia (proper)	1909-1918	10·3
United States	1914-1920	14·6	Argentina...........	1914-1920	9·7

It is believed that, when more scientific methods of cultivation are widely adopted in New South Wales, and land is properly fallowed, tilled, and manured, the yield per acre will be increased considerably; and a further favouring factor exists in the great possibilites that attach to the improvement of wheat types by plant-breeding. However, it is anticipated that the warm climate and the prevalence of hot winds during the ripening period will always militate against a high average yield being obtained in New South Wales, such as is obtained in more humid countries.—*Official Year Book of New South Wales.*

Pure-breds the Better Earners.

It is becoming more generally recognised that the earning power of pure-bred stock is considerably above that of scrub stock, even if sales of progeny be eliminated from consideration. That this principle holds good with dairy stock in an exceptional degree will, I believe, be admitted. The fact is becoming evidenced in the increase in the proportion of pure-bred dairy bulls in use in dairy herds. During the 1917-18 season some 8·5 per cent. of the total bulls in such use were pure-bred Jersey, Friesian, Ayrshire, or Guernsey. During the 1921-22 season the percentage was 14·5, and a marked increase may be expected during the next decade.—W. M. Singleton, Director of the Dairy Division, in the New Zealand *Journal of Agriculture.*

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Flixweed (*Sisymbrium Sophia* L.).

(*Cruciferæ*—Hedge Mustard Family.)

Botanical Name.—*Sisymbrium*, explained in the *Gazette* for November, 1922, page 815: *Sophia*, the wisdom of the early surgeons, being used by them in hæmorrhage.

Common Names.—Flixwort, and Fluxweed, from its use in dysentery, a disease that was formerly called flux.

Popular Description.—An erect annual, 6 inches to 3 feet high, the whole plant more or less covered with whitish hairs that give it an ashy-grey appearance. Leaves finely divided into numerous narrow segments. Flowers small, pale yellow. Seed-pods erect, slender, about ½ inch long, and containing many small, flattish, red-brown seeds.

Botanical Description.—Root annual, small tapering, stems a few inches to 3 feet high, erect, branched, terete, foliaceous. Leaves alternate, spreading, doubly pinnate, or perhaps more properly pinnatified, for the principal and partial divisions are all confluent: the ultimate segments lanceolate, acute, entire, more or less hairy: the terminal ones largest. Flowers very small, pale yellow. the minute petals almost hidden by the calyx, which has nearly as much colour as the petals. Inflorescence at first corymbose, but soon grows out into a very long spike of numerous slender pods, which stand erect on spreading stalks. Seeds numerous, small, and reddish.

Where Found.—It occurs in fields and waste places throughout the United Kingdom, and is common in Europe, Northern Asia, and North America. It has also made its appearance in New Zealand. During the last twelve months it was forwarded to the National Herbarium for identification by Stock Inspector Kenny, Pombala, who collected it on Mr. John Taylor's farm at Ando, in the Bibbenluke district.

Uses.—All the mustards are more or less eaten by stock in the early stages of their growth. Some of them are palatable and nutritious, and are kept within bounds on well-stocked grazing areas. Flixweed does not appear to have much to recommend it from a pasture viewpoint, as there is a total absence of any reference to its fodder value in modern literature. According to Linnæus, sheep and kine eat the plant, horses and goats are not fond of it, and swine refuse it. In India its seeds are used medicinally as a substitute or adulterant for those of *Sisymbrium irio* (London Rocket).

The plant was formerly prescribed in dysenteries and hysterical cases, and the seeds were given to destroy worms. The force of gunpowder is said to be augmented by mixing a tenth part of the seed with the other ingredients, but none of these virtues and qualities have been well ascertained.

Other Allied Species.—Four other mustards have already been introduced into the State, namely, Common Hedge mustard, Indian mustard, Tumbling mustard, and London Rocket. All are bad agricultural weeds that grow up and ripen or mature with the grain.

Flixweed (*Sisymbrium Sophia*).

Its Bad Points.—Flixweed when once established is hard to eradicate. It causes considerable loss in wheat and oat fields, growing up with the crop, and where thick smothering out the young wheat and completely taking possession. It depreciates the quality of hay by its impurities, and causes heavy loss of grain by choking up the harvester.

Means of Control.—Flixweed ripens its seed about the same time as wheat or oats, and thus seeds the ground for the new crop in the following late summer and autumn. After harvest, stubble should be burnt over to destroy as much seed as possible, followed by light fallowing to stimulate germination, surface cultivation to be continued at intervals as the weeds advance up till the time of the final ploughing before sowing. Many seeds will germinate with the grain; these can be harrowed out with a tine harrow when the crop is a few inches high. The harrowing can be successfully and advantageously carried out until the crop becomes too tall. Plants that have escaped the harrow should be hoed or pulled out before they come into flower. All seed-laden plants should be carefully burnt.

All species of mustards can be successfully controlled by spraying with iron sulphate, and certain crops that are grown in small areas might be treated in this way. The most effective spray has been found to be a 20 per cent. solution of iron sulphate, which can be made up as follows:—

For every acre to be sprayed, put 100 lb. of iron sulphate into 400 lb. of water and stir well until dissolved. About 10 to 15 minutes is required to dissolve the iron sulphate.

Spraying with 2 per cent. copper sulphate (10 lb. copper sulphate dissolved in 50 gallons of water) gives good results according to some authorities, but the mustard must be young, or the spraying will be valueless.

The spraying should be done on a bright, warm day, and not until the dew is entirely off the plants. Mustard can best be killed when the young plants are in the third leaf and the old ones in bud.—(Extracts from "Weed Pests of Idaho and Methods of Eradication.")

The Cultivation of Saltbush for Feed.

The most satisfactory variety of saltbush to grow for feed and shade in dry districts is the Old Man variety (*Atriplex nummularia*). This is the large, bushy sort that is cultivated as a hedge plant. It withstands dry conditions well, and is readily eaten by all classes of stock.

The best plan is to sow the seed in nursery beds, transplanting into the field when the plants are about 12 inches high. Field planting of the seed (whether by broadcasting or drilling) seldom gives satisfactory results, and, although the method recommended is rather irksome, it is the most efficient in the long run. Good quality seed will germinate in the nursery beds in about ten days, and the plants should be large enough to be grazed lightly in eight to twelve months.—J. N. Whittet, Agrostologist.

An Efficient Scalding Vat for Pigs.

E. A. SOUTHEE, Principal, Hawkesbury Agricultural College.

THERE is some considerable variation in the scalding methods adopted by farmers for removing hair, scurf, and dirt from pigs after slaughtering, and the use of a proper scalding vat is by no means universal. As the methods of scalding adopted in the treatment of pigs' flesh for the making of pork or bacon have a direct effect on the condition and general appearance of the finished product, the following description of the method and type of vat that have been found satisfactory at Hawkesbury Agricultural College may be of use in establishing uniform methods of treatment among farmers.

The vat is convenient, efficient, and simple enough for any farmer to construct. It is built of hardwood and lined with galvanised sheet iron of heavy gauge, the dimensions being shown on the accompanying plan. For

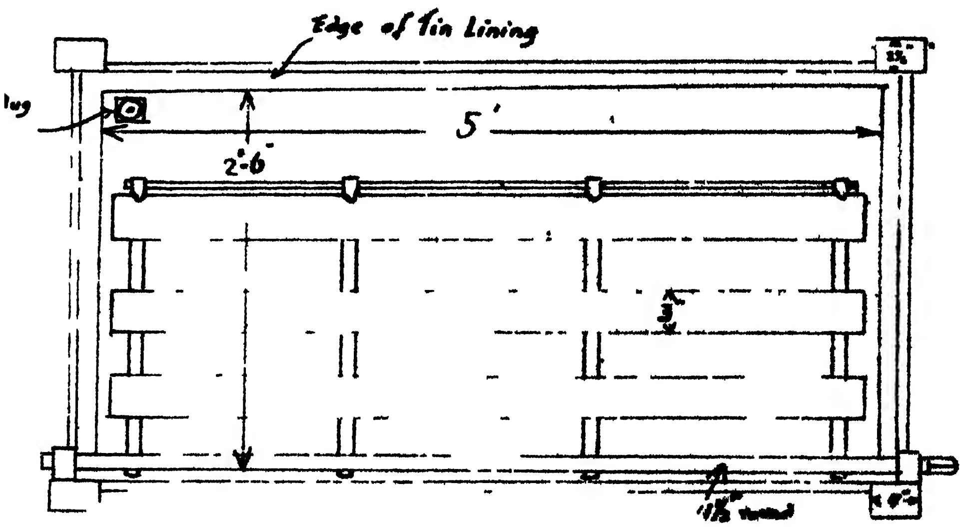


Fig. 1. Top Elevation of the Pig-scalding Vat at Hawkesbury Agricultural College.

scalding, the vat is about three-quarters filled with hot water at the proper temperature. The temperature required and period of immersion vary slightly according to the breed and particularly the size of the animal, the range of temperature being from about 150 to 170 deg. Fah., and the time of immersion from one to two minutes. The practice at the College, in the case of a pig about six months old, is to scald the animal at a temperature of 160 deg. Fah. for a period of one and a half minutes.

The vat is provided with a carrier rigidly attached to a round iron rod, one end of which is squared off to take a lever arm. Preparatory to scalding, the carcase is placed on the carrier which is held in position over the vat by means of a strong batten. The batten is removed, and the carcase on the carrier is lowered gently into the water by the operation of the lever

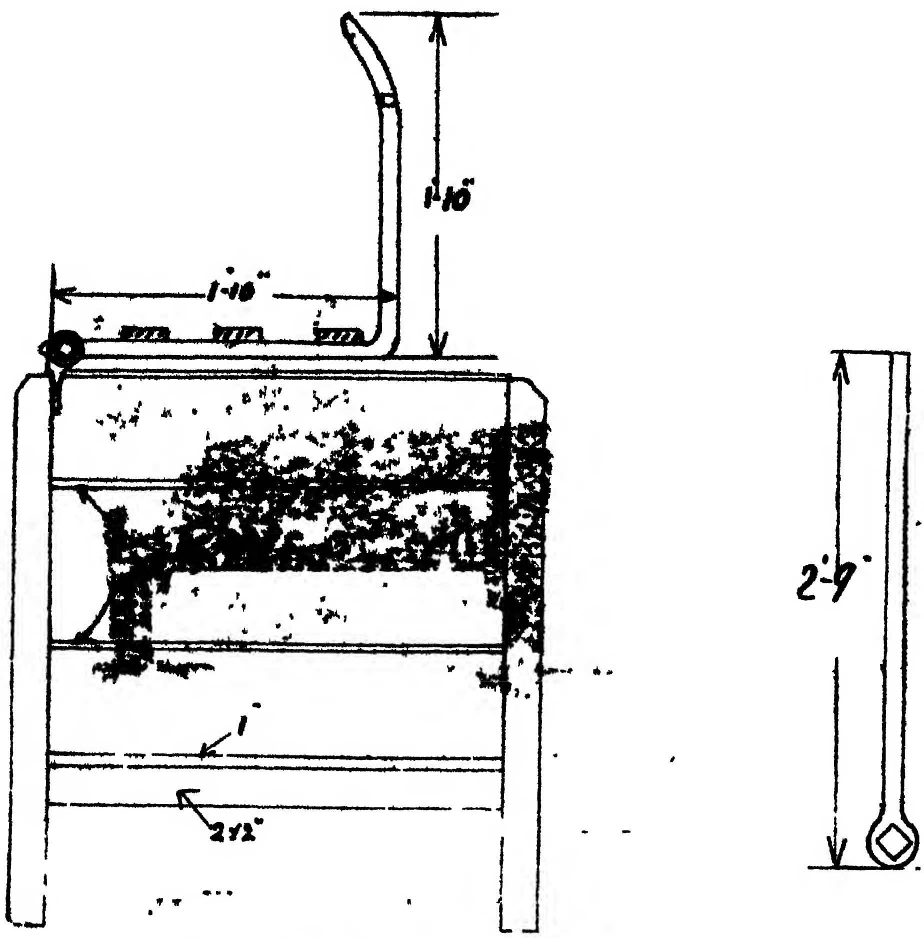


Fig. 2.—End Elevation of the Vat. On the right the Lever Arm.

arm. The carcase is wholly immersed, and, to ensure thorough treatment, is kept moving by means of the lever arm. The criterion for complete scalding is that the hair from the neck and forelegs should come away freely: at this stage the carcase should be removed quickly. Scraping should commence immediately, starting with the head and feet, and be continued, with frequent applications of hot water, until all hair is removed.

The vat is provided with a plug-hole at one corner to allow the water to be drained off.

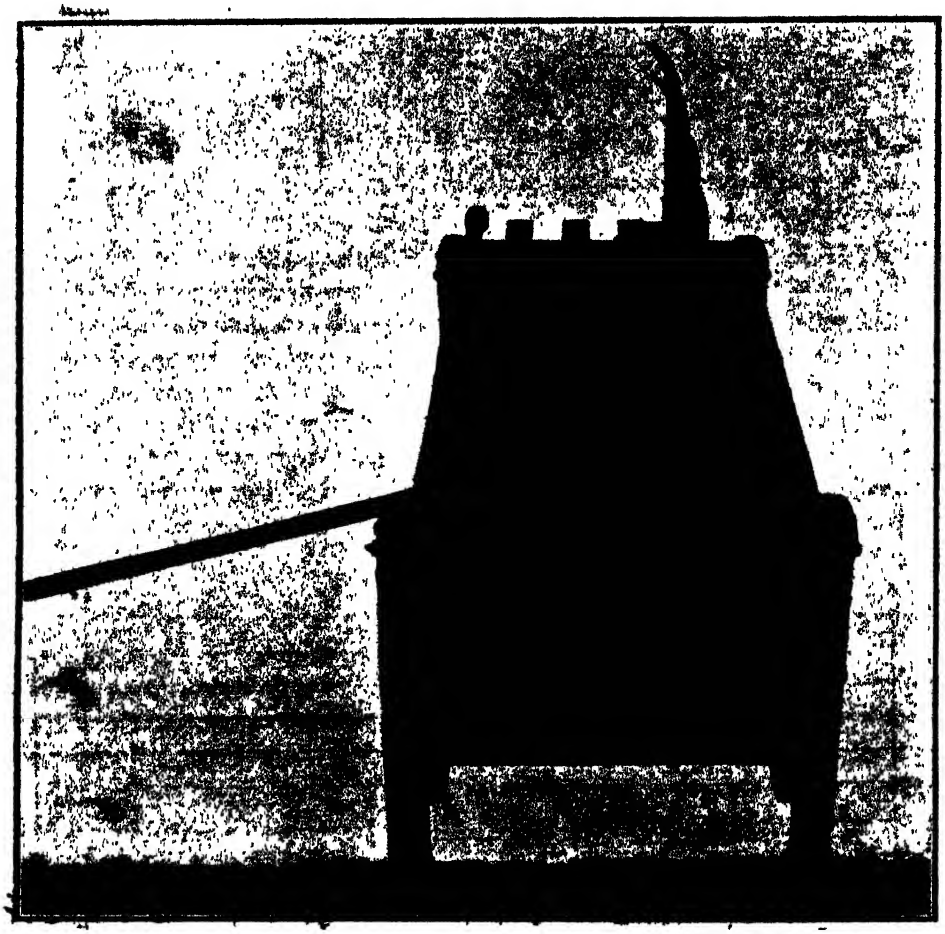


Fig. 3.—A Vat made on approximately the same lines as indicated in the previous illustrations.

EXPERIMENTS IN THE BLEACHING OF WALNUTS.

EXPERIMENTS in the bleaching of walnuts by various processes were carried out recently at Hawkesbury Agricultural College, different parcels of nuts being, (1) sulphured only for three-quarters of an hour; (2) dipped in a bleaching solution and sulphured for three-quarters of an hour; (3) sulphured only for one and a half hours; (4) dipped in bleaching solution and not sulphured; and (5) left untreated.

Dipping in bleaching solution only (4) resulted in a product good both in colour and flavour, and this treatment was considered the most effective. The formula according to which the bleaching fluid was prepared was 25 lb. chloride of lime, 18 lb. sal. soda, dissolved in 50 gallons water, sulphuric acid being added to the clear liquid (drawn from the settlings) at the rate of 1¼ lb. to 425 lb. of the solution. The period of immersion is about five to ten seconds, and after being dipped the nuts are immediately dried.

Poultry Notes.

October

JAMES HADLINGTON, Poultry Expert.

ALTHOUGH hatching time is now past there must be no respite from the concentration necessary to bring the rearing season to a successful issue.

Of the two operations, hatching and rearing, the former is much the simpler. Almost any person of ordinary capacity with a modern incubator, following such simple rules as have been laid down in these notes from time to time, and as late as June last, can manage to hatch good "hatchable" eggs. Rearing, however, is a less mechanical operation, and it requires skill and judgment as well as aptitude to follow and apply the simplest rules on the subject. Failure is not always due to lack of industry, and many hard "triers" are not successful at rearing. The trouble in such cases generally is that they "try" too many things—or methods—and get hopelessly mixed in their efforts to succeed. If proof is required that such is the case, it will be found in the fact that some successes are made with crude or very indifferent brooding and rearing plant, while others fail with the best of equipment. The latter are the persons who blame everything but themselves for their non-success.

Obsessions of one kind and another are the greatest obstacles to successful operations. Departure from the simple rules for brooding, such as have been laid down in these notes for years past, often leads to trouble. Of all such departures, failure to maintain the proper temperature necessary to successful brooding with heated brooders is the most frequent. Another is failure to use thermometers to ensure that the correct temperatures are maintained. Yet another is the idea that the temperatures advised are too high, and that the chickens would be hardier if brooded at lower temperatures. This last is a great fallacy and one which probably leads to more troubles than any other of the multiplicity of ideas that afflict the poultry farmer. The cause of this is not always the farmer's lack of will to learn, but unsound advice that has come from sources lacking definite experience on the subject. Many of the persons responsible for giving advice, both verbal and in literature, would cut sorry figures if put to it to make a living from poultry farming themselves. Indeed there are some poultry farmers whose advice would not be so highly valued if the recipient had a proper appreciation of the performances of their tutors. Such are some of the vicissitudes to which the novice poultry keeper is exposed!

Diseases of Chickens.

Another obsession from which poultry farmers suffer is the disease bogey. Many work in constant fear that some fell disease is waiting to swoop down upon their chickens and wipe them out. The result is a constant application of what they consider preventive measures other than the one that is absolutely essential—proper sanitation. For instance, chemicals are put into drinking water, with some vague idea of preventing disease. It

scarcely enters into the calculation what particular disease is to be prevented, but most useless and unscientific practices are often resorted to, and more harm is done than good. Thus many poultry farmers pass through months of anxiety during the rearing season, fearing something that in all probability would never happen if they trusted a little more to common sense and less to chemicals.

Diseases of baby chickens there are, the most common being coccidiosis, aspergilliosis, and white diarrhœa—all due to specific micro-organisms, which must be present to cause the particular disease. But what is not generally realised is that the causal organisms are probably present wherever poultry is kept, and only await favourable conditions to become active.

The writer's experience goes to show that most cases of disease have followed upon a lowering of the vitality of the chickens and a weakened power of resistance to disease germs. It should be understood that in rearing chickens one is dealing with an extremely tender life, and that chills, overcrowding, and impure air are the factors that expose them to attacks that they would in all probability escape under better conditions. In short, faulty brooding is indirectly responsible for probably more than 90 per cent. of disease among chickens.

Experience shows, too, that the over-anxious poultry farmer is the one most often in trouble. Hence it is that some of the most apparently careless of rearers succeed better than many others who are always fussing around attempting to prevent disease by such means as those mentioned. As an instance—many have yet to learn the lesson that the way to prevent packing, with its attendant evils, is to provide adequate temperatures in the brooders; and, again, many of the troubles for which some highly scientific explanation is sought are possible of simple solution.

The Second Stage of Rearing.

Most of the troubles attendant upon rearing in the stage that follows removal from the brooders are due to the transfer from warm to cold quarters. During September and October the weather is mostly changeable, warm days being followed by cold nights, or fairly warm spells by periods of low temperatures. These factors should be taken into consideration when providing housing accommodation. If large batches of, say, 100 or more chickens are moved into ordinary open-fronted poultry houses, such as are used for adult stock, the risk of packing at night is very great, and the usual result is that some of the strongest and best of the chickens are found dead next morning. As a matter of fact, these are the chickens that have burrowed their way under the pack seeking warmth and have become suffocated. Bare heads and abdomen, and the absence of the feathering that should form the wing coverets at the shoulders furnish still further evidence of packing with its train of evils.

The theory usually advanced to account for these conditions is that the chickens are feathering badly, and solution is sought in some such remedy as feeding for feather growth. The facts of the case are that the trouble is not due to the chickens' inability to grow feathers, but to the feathers being literally sweated off in the nightly packs.

This trouble is not altogether confined to brooder or artificially-reared chickens, cases of the kind being often found in chicks that are brooded with hens. In such cases the same cause is operating—mostly through a hen brooding her chickens in a small box or corner, especially when too many chickens are given to her, or when they are run with the hen longer than is necessary.

The Third Stage of Rearing.

The third stage of growth—say, three to six months old, the age at which they are most susceptible to the catarrhal type of roup—is the period of growth during which many thousands of chickens are lost and others ruined in regard to growth and development to such an extent as seriously to affect their prospects of making profitable stock.

It is a notable fact that many poultry farmers blame draughts for bringing on roup, but the fact is that housing in too large numbers and want of proper ventilation are the greatest factors in bringing about this trouble. As mentioned in the early part of these "notes," micro-organisms are the causal agents in this disease also, but it remains for the conditions to become favourable before they become as menacing as they are in outbreaks of roup. Hence it is that on the Hawkesbury Agricultural College poultry section and at the Government Poultry Farm at Seven Hills, all young stock of this class are housed in fifties, in houses 12 feet x 6 feet, and eight of these houses are used to the acre. Stock is rarely put into larger houses in greater numbers until after six months of age.

Housing.

In connection with the question of housing, some comment has been made regarding the use of narrow houses. There are two reasons for the existence of the narrow house: one is that it is a matter of ascertained experience that young stock, such as those mentioned, are healthier housed in shallow houses where they are roosting near to pure air, than when housed in quarters of greater depth and subjected to stuffy conditions; and the other is that the narrow house is less expensive to construct. Larger houses of the semi-intensive type can be used with advantage for mature birds. The initial cost of such housing is just about double that of roosting room only for the same number of birds.

October Work in the Apiary.

The progress in the hives should be marked during this month, and it is generally a busy time for the apiarist. Where progressive conditions obtain, sufficient accommodation must be allowed the bees in the hives to provide for the rapid increase in population of the colonies, otherwise abnormal swarming may result. With progressive times it is generally a good chance this month to raise queen bees to replace any that have proved unsatisfactory. Bee farmers, as a rule, should go in for queen-rearing more than they do. It is a distinct advantage to keep a few queen-rearing nuclei going through the season, so that a good queen can be obtained when required at a moment's notice for the larger hives.—W. A. Goodacre, Senior Apairy Instructor.

The Construction of Dams.

J. O HENRICK, Instructor in Agriculture, Hawkesbury Agricultural College.

In Australia there are extremely few areas where the rainfall is evenly distributed throughout the year, and, in many districts, though the average annual fall may be quite sufficient for the needs of both crops and stock, the incidence of the rains is such that there is a shortage at some periods and a large amount of water is lost by run-off at others.

An adequate supply of water for stock purposes all the year round is an obvious necessity on any farm, and under Australian conditions the usual means of ensuring this is to store the water in tanks or dams. A large number of dams already exist in New South Wales for this purpose, but many more are needed, and in a good many localities the building of dams for the storage of water for irrigation purposes promises to be profitable. In parts of the Goulburn Valley (Victoria) and in southern Victoria, areas are being successfully irrigated from dams by gravitation, and there appears to be no reason why a similar system should not be instituted with success in districts in this State where the rainfall is fair—even though it be variable—and where the country affords opportunity. The main items are a well-placed dam or dams and a commonsense use of furrows or a spray system of irrigation. An engine may be necessary to pump water from a gully dam to a hillside dam, if both types are being used, and if the gully dam is situated too low to be used direct for irrigation purposes.

Types of Dam.

Dams may be constructed on hilltops, on hillsides or in gullies. Hilltop dams are constructed on the top of the crest to allow of the water being reticulated to the lower areas, but they have no catchment area and must be filled by pumping from a gully dam or a stream at a lower level.

Dams are more commonly built on hillsides when irrigation is practised; this type possesses the advantage of height and yet receives a large amount of the run-off.

Gully dams are frequently used: in fact they are the general type for stock purposes in New South Wales, which is unfortunate, for the watering of the stock direct from the dam results in the breaking down of the sides with the consequent loss of storage capacity, and, in some cases, contamination of the water

Construction.

The conformation best suited for the construction of a dam is where the sides of a general depression approach each other abruptly below a rather broad portion of the depression (see Fig. 1), the embankment being placed

across the narrowest portion. The site of the wall having been decided on, and pegs to mark its central line having been set out, the height of the wall should be decided on, for on this depends the dimensions of the base of the wall. A margin of 3 to 4 feet above the desired water level should be allowed. In fixing the height of the wall due consideration must be

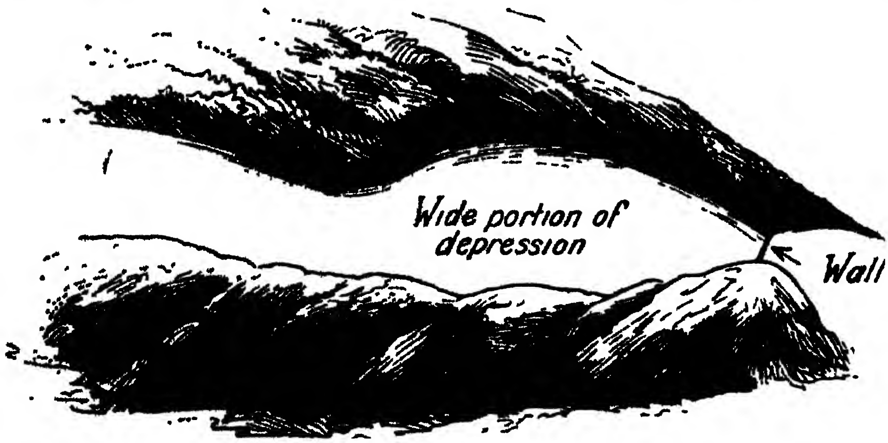


Fig. 1.—A Type of Depression suited to the construction of a wall dam.

given to the amount of water that will be stored as the result of the height decided on and the conformation of the depression, and shafts must be sunk to ascertain how far it will be necessary to go down for a good foundation. Sandstone, slate, or clay make good foundations, and granite and basalt may be good, though often they contain seams. Sand and gravel are not suitable.

The other measurements of the wall should be proportional to its height, as follows :—

Water face or batter slope	3 to 1
Outer face	2 to 1
Crest (or thickness at top) to height	2 to 3

Crest to base line will thus be in the proportion of 2 to 17.

By way of illustrating these proportions, it may be stated that, if it is decided to impound 12 feet of water at the wall, the wall should be made 15 feet high from the base; and, in the proportions given above, the other measurements should be—crest, 10 feet; base line, 85 feet (50 feet inwards and 35 feet outwards).

These measurements having been calculated, the inner and outer toes should be marked off, and the wall trench excavated. This is done by first ploughing off the surface soil between the toes and scooping it off to beyond the outer toes for subsequent use, and then carrying on the excavation till good holding ground is met with.

To make sure that water will not creep through the bottom of the wall a narrow trench may be dug along the central line of the wall trench a little

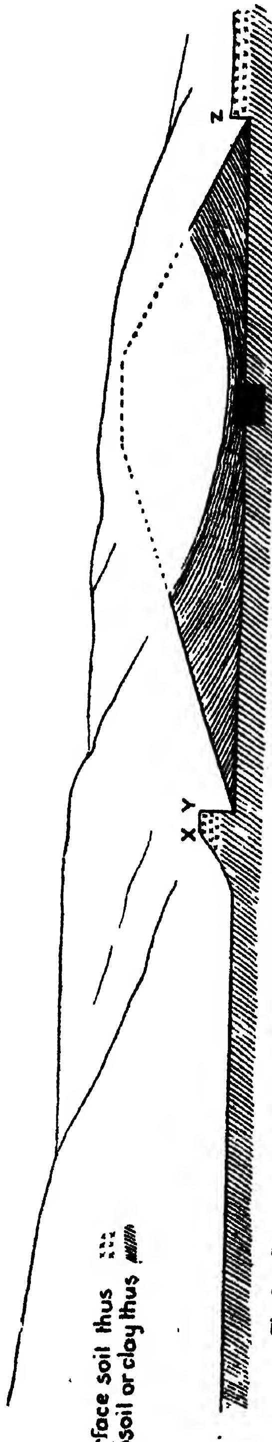


Fig. 2.—Cross Section of Wall of Dam, showing "toes" at Y and Z, the commencement of excavation of Dam at X, and the central core. Note the method of dishing the layers in the wall. The dotted line shows the position the wall will occupy when complete.

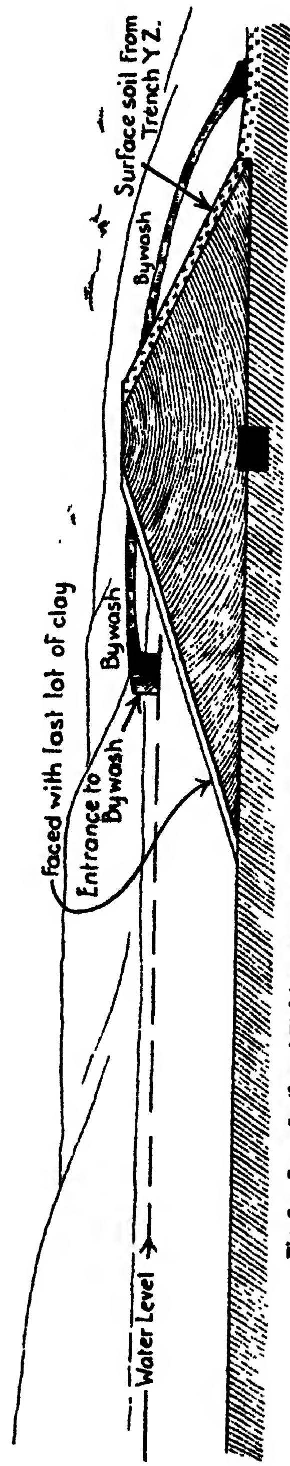


Fig. 3.—Cross Section of Finished Wall, showing water level, and on the far side the entrance and outfall of the by-wash.

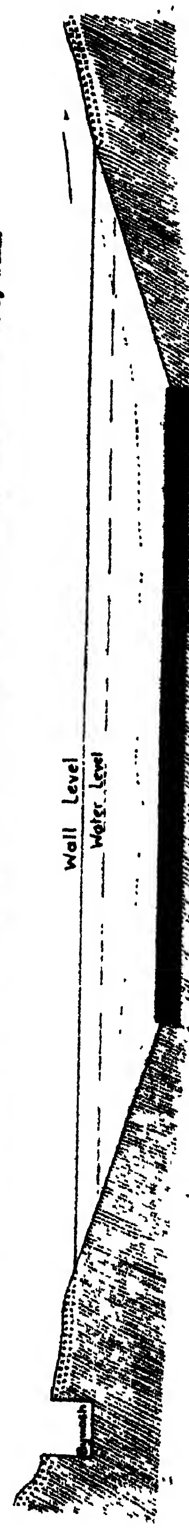


Fig. 4.—Longitudinal Section of Wall across the valley, showing entrance to bywash, wall level, water level, original ground level (dotted line), and central core.

way into the firm clay or rock, filled with puddled clay, and built up to about 6 inches higher than the floor of the main trench (see Fig. 2.). This central core is only an added precaution, and is not considered necessary in the case of low-walled farm dams.

The main wall is formed by scooping the soil from within the dam, working on the flat as much as possible, and building on the area within the toes. A start is made a few feet from the inner toe, the surface soil being placed well out toward the outer toe. As the excavation continues the better material is kept towards the centre of the wall, and the clayey soil is kept for the inner facing, each layer being " dished " slightly towards the centre, and as much consolidation as possible being effected by working over the dumped soil (see Fig. 2.). If this system is adopted the bank is firmly consolidated towards the centre when it settles, and it will not crack or let water through.

The By-wash.

As soon as the wall is up to the height of the proposed water level, a by-wash should be constructed. This should be done before the wall is completed as a safeguard against a sudden flood of water. The by-wash is really a channel with its bed level at the entrance on a level with the height it is proposed to have the water rise in the dam, and it is designed to carry off surplus water and so prevent the water in the dam rising above a safe level. It circles the wall, starting from within the dam near the wall, and returning to the depression well down the gully from the wall (see Fig. 3.). The entrance from the dam should be metalled or logged to prevent scouring. The by-wash should never be placed in the wall, nor should it return to the depression close to the outer toes, owing to the danger of scouring.

With the completion of the by-wash the wall can be completed. The last layers that form the water face of the wall should be taken from the bottom of the dam and should be good retentive material to form a good puddle. The surface soil placed aside when the excavation was commenced is then placed on the outer face, and grass planted to prevent washing.

Canadian Experience with Sunflower Silage.

Summarising the results of experiments carried out at Indian Head Experimental Farm, Saskatchewan, with Shorthorn dairy cattle to determine the relative feeding values of sunflower and maize silage, G. B. Rothwell, Dominion Animal Husbandman, writes:—"The general deductions from these tests would seem to indicate that—(1) the feeding value of sunflower silage is slightly lower than maize silage for milk production; (2) its feeding value in the maintenance of dry pregnant cows is equal to and possibly superior to maize silage; (3) sunflower silage is equal to maize silage in palatability; (4) the only factor limiting the feeding of sunflower silage would seem to be its unusual stimulation of the kidneys."

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Growers who have crops suitable for seed purposes are invited to communicate with the Department of Agriculture, Sydney. This should be done in ample time to allow of an inspection of the crop to be made before harvesting.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Maize (varieties in order of maturity):—

Wellingrove	Manager, Experiment Farm, Glen Innes.
Iowa Silvermine	J. Morphett, Farm 863, Stanbridge, *via* Leeton.
	P. A. E. Gersbach, Farm 864, Leeton.
Funk's Yellow Dent	T. C. Weedon, Beverley, South Gundagai.
	J. R. Knapp, Bolong, *via* Nowra.
	L. B. Garrad, Milton.
	A. E. Brown, Mt. Keira.
Craig Mitchell	K. W. D. Humphries, Muswellbrook.
Coodra Vale . .	R. S. Lindeman, Coodra Station, Wee Jasper, *via* Yass.
Hickory King	J. W. Henry, Bolong, *via* Nowra.
Leaming	E. W. Alway, Jones Island, Manning River.
Giant White	J. Ward, Sherwood.
Manning Silvermine ..	W. J. Adams, Dumaresq Island, Manning River.
Golden Beauty	R. Richardson, Tinonee, Manning River.
	A. M. Hooke, Kootingal, Taree.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy ...	F. Waters, East Kempsey.
	G. P. Collins, Fairy Hill, Casino.
	J. P. Mooney, Taree.

Grain Sorghum:—

Feterita . .	Manager, Experiment Farm, Coonamble.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst

Sweet Sorghum:—

Early Amber Cane	Manager, Experiment Farm, Bathurst
Selection No. 34	Manager, Experiment Farm, Yanco

Potatoes:—

Satisfaction	H. F. White, Bald Blair, Guyra.
	G. H. J. Price, Yarrowyck-road, Armidale.
Late Manhattan	K. Bowen, "Newport," P.O., Orange.
Langworthy	K. Bowen, "Newport," P.O., Orange.
Symington	H. F. White, Bald Blair, Guyra.

Millet:—

Japanese	Manager, Experiment Farm, Coonamble.
Broom . . .	Manager, Experiment Farm, Coonamble.

Lucerne:—

W. E. Myring & Sons, "Nungaroi," Palinmallawa.
A. L. Thomas, "Merrivale," Bedgerebong, *via* Forbes.

Shearman's Clover (Roots):—

J. H. Shearman, Fullerton Cove, *via* Newcastle.

American Pear Gramma:—

J. Lambert, Taree.

Peanuts:—

Valencia...	S. Broom, Farm 1298, Griffith.
Chinese ..	S. Broom, Farm 1298, Griffith.
White Spanish	S. Broom, Farm 1298, Griffith.

Grasses:—

Elephant Grass (Roots)	Manager, Experiment Farm, Lismore
	Manager, Experiment Farm, Yanco
	Principal, H. A. College, Richmond
Kikuyu Grass (Roots) ...	Principal H. A. College, Richmond
	Manager, Experiment Farm, Cowra
	Manager, Experiment Farm, Lismore
	Manager, Experiment Farm, Grafton
	Manager, Experiment Farm Glen Innes
	Manager, Experiment Farm, Yanco.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

"Doing Better than his Neighbour."

Investigations have definitely proved over and over again the value of testing dairy cows for both milk and butter-fat results. Yet it is surprising to find that the majority of those engaged in dairy pursuits are still satisfied to remain ignorant of what cows are profitable and what are not profitable. These farmers appear satisfied to grope along in the dark, as it were. The only check many dairy-farmers have as to the money value of their herds is the monthly accounts they receive from the factory to which they forward their milk or cream supplies.

Very few dairy-farmers record the weight of each cow's milk at milking time, though such records could quite easily be obtained and noted just prior to emptying the bucket into the milk vat. Many farmers are under the foolish impression that this means a waste of time. On the contrary, it will be found that much valuable information will be gained by the systematic weighing of each cow's milk. A practice—much too common—is the milking of one cow after the other into one bucket until the bucket is full. No record of the weights of milk of the individual cows is then possible.

After freshening, a cow may possibly give 2 gallons or more of milk at a milking, but in two or three months' time she will decrease to half a gallon or less per day for the rest of the milking period. Where the milk is never weighed this gradual yet very appreciable decrease is probably not observed, and the cow will remain in the herd, though of little value to the man who wishes his business to pay.

Where herd-testing is carried out in a regular and methodical manner, milk-weighing is perhaps not necessary, but in outlying centres, or for a beginner in dairying, it would be of great advantage and would amply pay for the time occupied in weighing and recording the weight of milk of each cow. But better still, in outlying centres the testing could be undertaken by the farmer's own children after a few lessons in testing; or the local factory manager might be prevailed upon to do the work.

The information thus secured would be of very great value to the dairyman who is desirous of "doing better than his neighbour."—George Rowe, Senior Dairy Instructor.

Orchard Notes.

OCTOBER.

W. J. ALLEN and W. LE GAY BRERETON.

Spraying.

LAST month precautions were given to reduce the coming season's infestation of moth, but unfortunately however conscientiously such precautions are carried out some of the carry-over grubs of the previous season will escape destruction, and consequently spraying with lead arsenate must be resorted to with the object of poisoning as many as possible of their offspring. The first lead arsenate spray should be applied when the petals are falling, and before the calyces of the earliest blossoms have closed.

In many of the colder districts the first of the new generation of grubs are not hatching for some time after this period, and some growers are of the opinion that the first application should be delayed till closer to the time when the hatching of the eggs takes place. But it should be remembered that when this application is carried out prior to the closing of the calyx, the poison is deposited within the calyx cavity and imprisoned therein when it closes, thus preventing attack through the calyx.

The fact that many years ago, before spraying with poisons for codlin moth was practised, the entry of the grubs through the calyx of apples and pears was very common, whereas since spraying has become general it is quite rare to find apples and pears attacked at that point, can be taken as an indication of the value of the calyx application. Not only do we deprecate any retarding of the first application, but we would urge what may be termed a double calyx application; that is, spray first before the calyces of the earliest blossoms are closed, and again within a few days before the calyces of the later blossoms close. This is practicable where the capacity of the spraying plant is sufficient for the area being operated. And a reminder is not out of place here, that the capacity of efficient power pumps can be very considerably increased by using long distance nozzles, such as the spray gun or pistol, and by making provision for speedy mixing, filling, and carting the mixture out to the pumps.

If the weather be favourable for black spot of apples or pears in districts where this disease is prevalent, summer strength of either lime-sulphur or Bordeaux mixture should be combined with the calyx application of lead arsenate. Although the respective merits and faults of these two fungicides were mentioned last month, it may be well to state that the apple and pear appear to be most sensitive to Bordeaux injury at the calyx stage, and the use of that spray should be avoided, especially at this except where it is absolutely necessary to employ it.

Attention will still be necessary to trees from which peach aphis has not been eradicated by previous treatment. Directions for dealing with this pest were given last month.

Cultivation.

The general cultivation and chipping round the trees should be maintained, and special care given to any deciduous trees planted during the winter, and more so to any spring-planted citrus trees. These are not thoroughly established and may suffer during even the short dry spells that are liable to occur in the spring. If the soil immediately about them becomes too dry, which more often happens to refills where the neighbouring older established trees are likely to rob the younger plants of moisture, they should be watered. If irrigation is not available an ample furrow should be opened around the trees with a shovel or hoe, and a couple of buckets of water poured in for each tree. After the water has soaked away the furrows should be filled in again with dry soil to check evaporation. Trees watered in this way may require chipping a few days afterwards.

Disbudding.

Stocks that have been grafted or cut back to buds inserted the previous summer should be examined from time to time, to see that growths from the stock do not sap the shoots on the buds or grafts. Where the stocks are established trees that have been re-worked to a fresh variety, it is well not to rub out all the shoots from the stock, but to leave some of the weaker growing ones merely pinched back, so that they will afford some shade till the head of the tree is sufficiently reformed.

Where any scions of grafted trees have failed, leave ample strong shoots from that part of the stock to be budded later in the season.

During this month a start may be made with the marketing of Valencia Late oranges.

One Way to Success in Rural Organisation.

There are two ways of increasing the net returns from farming, viz., a lower cost of production and a better sale price. The former is largely under the control of the farmer, and it is due time that the latter was also more under his influence than is at present the case. There is only one way for the farmer to obtain a larger share in the final or consumer's price of products, and that is by organising. To the outsider the lack of organisation, and often also the lack of desire to organise, among farmers might lead to the conclusion that they are doing so well that they do not need to organise. We know this is not the case, though it is the most apparent explanation. Among those who do realise the need for organisation there is often an erroneous idea of the method whereby it is to be attained. There is only one way to success in organisation, and that is by building up through local units. Any attempt to superimpose organisation from above can only end in failure.—*Journal of the Department of Agriculture*, South Africa.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
Barrigan A. and H. Society	R. Wardrop	Oct. 9
Asiah Park A. Society	J. F. McInnes	„ 10
Deniliquin P. and A. Society	P. Fagan	„ 17
Griffith A. Society	M. E. Sellin	„ 17, 18
Gundagai P. and A. Society	J. Gardiner	Nov. 14, 15
Adamstown Agricultural Bureau	G. Brock	„ 16, 17
Macleay A. H. and I. Association (Spring Show)	N. W. Cameron	„ 16, 17
Lismore A. and I. Society	H. Pritchard	„ 20, 21, 22
Tweed River A. Society	T. M. Kennedy	„ 28, 29

1924.

Society.	Secretary.	Date.
Albion Park A. and H. Association	H. R. Hobart	Jan. 11, 12
Dapto A. and H. Society	E. G. Coghlan	„ 18, 19
Kiama A. Society	G. A. Somerville	„ 25, 26
Gosford A. Association	H. G. Parry	„ 25, 26
Wollongong A. H. and I. Association	W. J. Cochrane	„ 31 to Feb. 2
Berry A. Association	G. Gillam	Feb. 6, 7
Guyra P. A. and H. Association	P. N. Stevenson	„ 19, 20, 21
Alstonville A. Society	W. J. Dunnet	„ 20, 21
Nepean District A. H. and I. Society	C. H. Fulton	„ 21, 22, 23
Moruya A. and P. Society	H. P. Jeffery	„ 27, 28
Newcastle A. H. and I. Association	E. J. Dann	„ 26 to Mar. 1
Manning River A. and H. Association (Taree)	R. Plummer	Mar. 4, 5, 6
Tumut A. and P. Association	T. E. Wilkinson	„ 5, 6
Yass P. and A. Association	E. A. Hickey	„ 5, 7
Oberon A. H. and P. Association	C. S. Chudleigh	„ 6, 7
Berrima A. H. and I. Society	W. Holt	„ 6, 7, 8
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	„ 11, 12, 13
Mudgee A. P. H. and I. Association	J. H. Shaw	„ 11, 12, 13
Dorrigo and Guy Fawkes A. Association	A. C. Newman	„ 12, 13
Warialda P. and A. Association	Lanagan Bros.	„ 12, 13
Hunter River A. and H. Society (West Maitland)	J. S. Hoskins	„ 12 to 15
Crookwell A. P. and H. Society	C. H. Levy	„ 20, 21
Goulburn A. P. and H. Society	F. D. Hay	„ 20, 21, 22
Mydal A. H. and P. Society	S. Bruce Prior	„ 23
Tamworth P. and A. Association	F. G. Callaghan	„ 25, 26, 27
Kempsey P. A. and H. Association	E. J. Kimmorley	„ 26, 27
Campbelltown A. Society	J. T. Deane	„ 28, 29
Macleay A. H. and I. Association (Kempsey)	N. W. Cameron	April 2, 3, 4
Blacktown A. Society	J. McMurtrie	„ 4, 5
Orange A. and P. Association	Geo. L. Williams	„ 8, 9, 10
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	„ 9, 10, 11
Royal Agricultural Society of N.S.W.	H. M. Somer	„ 14 to 23
Clarence P. and A. Society	L. C. Lawson	May 7, 8, 9, 10
Hawkesbury District A. Association	H. S. Johnston	May 1, 2, 3
Murrumbidgee P. and A. Association (Wagga)	F. H. Crooker	Aug. 26, 27, 28

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Agricultural Gazette of New South Wales.

Conservation of Fodder.

SILAGE FOR THE DAIRY FARMER.

[Concluded from page 711.]

A. BROOKS, Works Superintendent.

Concrete Silos.

WHILST it is quite possible to get a handy farm carpenter to erect the timber silos, and to make a very satisfactory job of them, it is doubtful if such a man could be relied upon to make an equally good job of a concrete structure, especially of the reinforced solid-wall type. If several farmers could co-operate to have their silos erected at the same time or in succession to one another, they could engage the services of one skilled builder to see that the important details of the work were properly carried out. Such assistance as carting, mixing, lifting the concrete, &c., the farmers themselves could provide, and thus effect an appreciable saving in the cost of the structure.

Three types of concrete silo may be recommended to the attention of farmers—the circular solid-wall silo, the octagonal solid-wall silo, and the hollow concrete block silo. Carefully and skilfully constructed, they are equally strong and durable, but the one mentioned last is the cheapest to construct, because the blocks may be made and put in position in any convenient number, while with the others construction must go on daily until they are complete or good bond in the layers of the concrete cannot be made. Of the two solid-wall silos, the octagonal is the cheaper to build, as the forms are the most simple to make and require less material.

The Materials.

The selection of the materials for concrete work is very important. The cement must be from fresh stock, because if it has absorbed any moisture and become lumpy and hard it is unfit for use. It should be stored in a dry place, preferably on a wood floor. The sand for silo building requires to be fairly coarse, and must be clean and free from all vegetable matter. Fine sand requires more cement to make an equally strong job. The stone may be river gravel or crushed rock, graded to size. The latter is the best and makes the strongest work. River gravel should be screened for silo walls.

In some localities creek or river gravel is obtainable with the sand mixed with it. If clean and not too coarse, such gravel is well suited to the purpose, but it is well to test the quantity of sand and gravel in a cubic yard to ensure that they are present in the correct proportions, and that they may be corrected if necessary. A simple way to do this is to screen out a kerosene tin full of the stones, and then to pour water into the tin until it flows over the stones. Then pour off the water from the stone into another tin, and the

quantity of water in the second tin gives the quantity of sand required to fill all the voids or spaces between the stones. Any difference between the quantity of water so ascertained, and the quantity of sand screened out of the tin full of stones will have to be adjusted to get a proper mixture. It must be borne in mind that the object in the concrete work is to fill all spaces between the stones with the mortar made of the sand and cement.

Sand contributes from half to one-third of the amount of material used in making concrete, and the largest part is the stone, which should be passed through a screen from ¼-inch to 1½-inch mesh for wall work, and through a 2½ inch mesh for foundations.

Generally speaking, a good mixture is made of 9 cubic feet of stone, 4 cubic feet of sand, and 1 bag of cement. If less cement is used, the walls may be porous, and consequently will admit the air, and even rain may soak through.

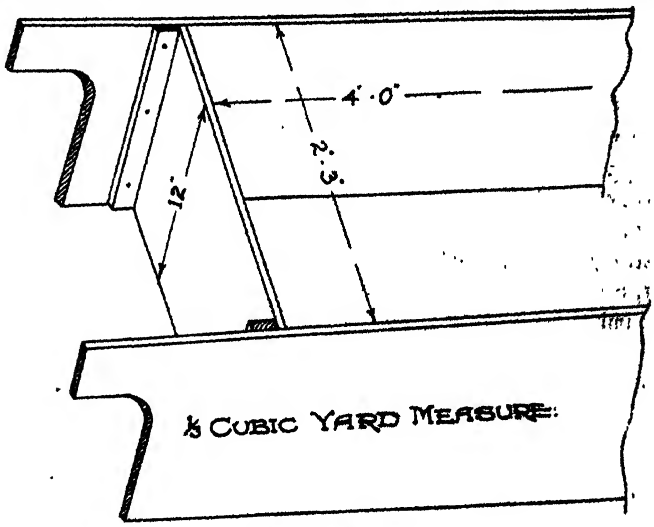


Fig 24.—A Mixing Box.

The Quantities Required.

For either type of concrete silo—that is, for solid 6-inch walls, or for 8-inch blocks—approximately the same quantity of materials is required.

In each cubic yard of concrete there will be about 1 cubic yard of stone, 12 cubic feet of sand, and three bags of cement. Therefore, in a silo 30 feet high, there will be approximately 31 cubic yards of concrete, including the footings 18 by 9 inches thick, as well as 2 cwt. of No. 8 fencing wire for reinforcement.

If the inside has to be plastered, another ten bags of cement and 2 cubic yards of sand will be required to lay on a thin coat, and if, because the soil is too soft there must be a concrete floor, another 3½ cubic yards of concrete will be required for a floor 6 inches thick.

For the door openings, six ½-inch steel rods 5 feet long and about 3 lb. of 12-gauge tie wire, to use where necessary, will also be wanted.

The Cost.

The cost of the above materials, and also of the labour required, depends so much on locality and conditions, that no definite amounts can be stated, but the quantities mentioned above are all for one size of silo, and a builder can therefore estimate for the cost in his own particular district.

Silos of 100-ton capacity should average about 45s. per ton, excluding the cost of the building plants for each type of structure, but including all labour at current rates.

For other sizes, if questions are addressed to the Under-Secretary and Director, Department of Agriculture, Sydney, a list of the materials will be forwarded to the applicant.

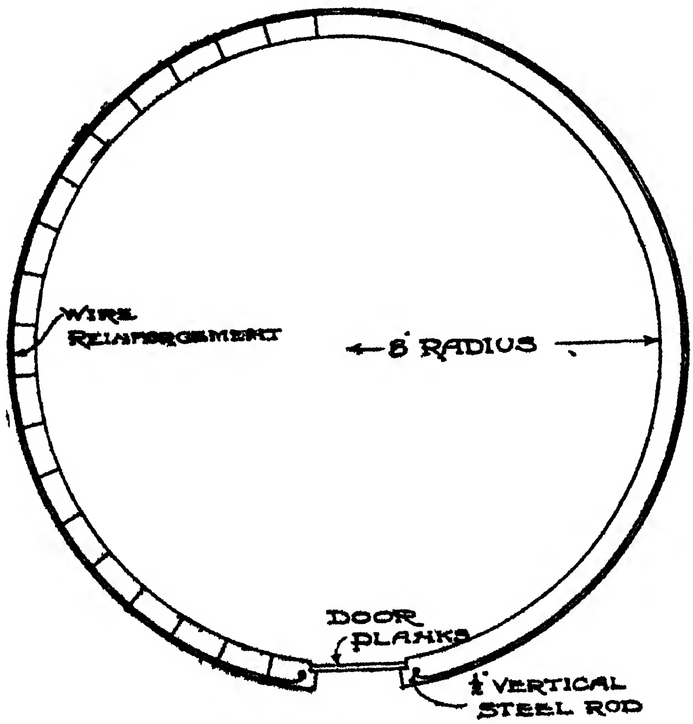


Fig 25.—Plan of Concrete Block Silo.

Mixing the Concrete.

Continuous mixing, such as can only be done by a machine, is undoubtedly the best, but only where a number of silos were to be erected could the purchase of one be recommended. Hand mixing, if carefully done, is quite suitable, and if the directions given below are followed, it will be found most suitable for the erection of one or even a few silos.

A wood platform is very necessary, made of 1¼ inch or 1½ inch planks, 9 or 12 inches wide, laid flat on a bed of sand or fine earth, the joints to be quite close together. The size of this platform should be about 12 feet x 10 feet.

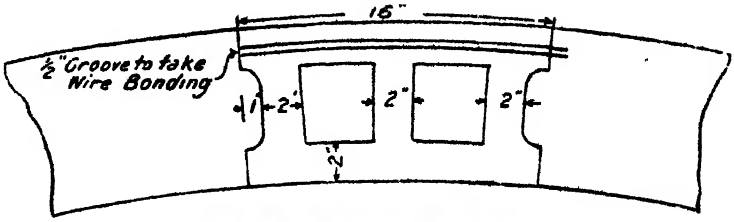


Fig. 26.—Plan of Concrete Block.

To correctly measure the quantities of materials, a box, 4 feet long x 2 feet 3 inches wide x 1 foot deep inside (see Fig. 24) should be used. It will hold 9 cubic feet. This box, placed near one side of the platform, is first filled with stone, then lifted and placed again on the platform, and almost half filled with sand. Before removing the box, empty on the sand the bag

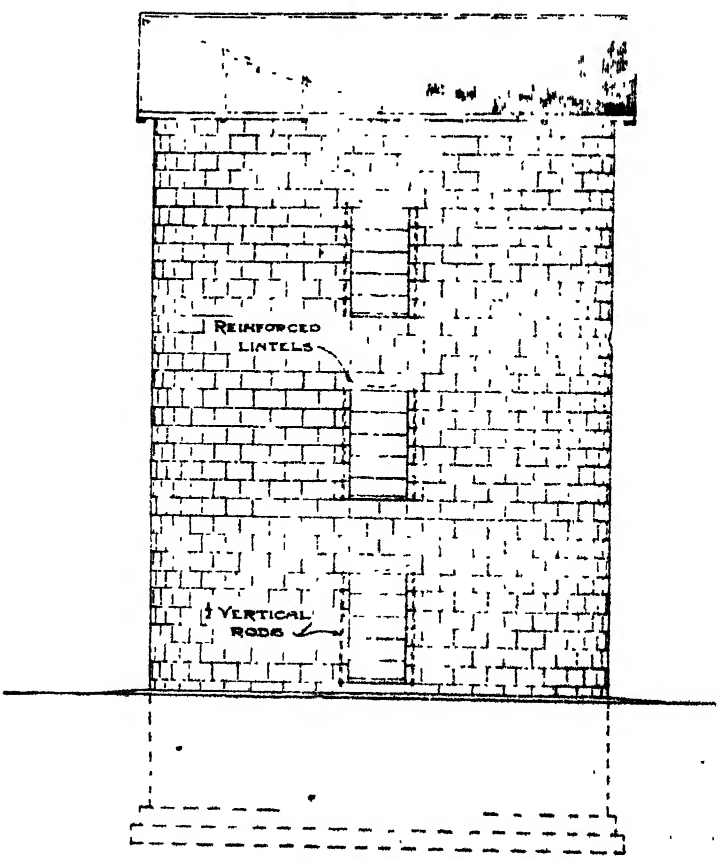


Fig. 27.—Elevation of Concrete Block Silo.

of cement, remove the box, and with square-mouthed shovels let two men turn over the heap, once away from the stone and again towards it. The mixture will be right if the colour is uniform. If not, another turn should be given or the whole may be raked with a garden rake.

The stone should be spread out on the board, the sand and cement spread over it, and the whole carefully turned over together, twice while dry, and again twice while a third man is watering it from a hose or through a watering can with a rose. The water should not be poured on as is done for mortar mixing, and the consistency when mixed should be just sloppy enough to make it run together when placed in the moulds.

It is not advisable to mix up large batches, as the cement begins to set in about thirty minutes after it has been wet.

For concrete-block making the mixture must be in smaller batches, and with much less water. The proper consistency for this purpose is that if a handful is pressed together it will remain in a lump when the hand is opened, and not stick to the fingers. This is necessary to enable the removal of the mould as soon as the block is made, so that the making of the next block can be proceeded with. The concrete of the blocks is, therefore, not as strong as that in the solid walls, but if care is taken with the curing of the blocks, by shading them from the sun and wind, and watering them at least twice daily for eight or ten days after they are made, good work will result.

The principal points in making these blocks is not to have the mixture any drier than is necessary, to pack the mould well by ramming the concrete well into it, especially at the corners, and to shade and water the blocks while they are curing. When the silo is being built these blocks should be well wetted before being set on the wall, to prevent them from absorbing the moisture out of the mortar joint too quickly.

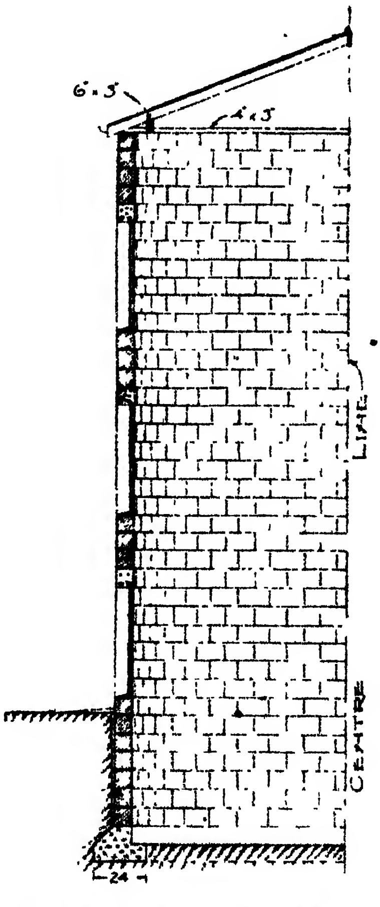


Fig 28.—Half-Section of Concrete Block Silo.

"Monolithic" is the term used when referring to a solid concrete silo or building re-inforced by steel rods, wire, or wire-netting.

When subject to a pulling or bending stress, concrete must be reinforced, because of itself it has a low tensile strength.

Ensilage is stated to exert a pressure against the walls equal to 11 lb. per square foot of surface, per foot depth of the silage. For instance, a silo 30 feet deep will have a pressure against the walls at the bottom of 330 lb. per square foot.

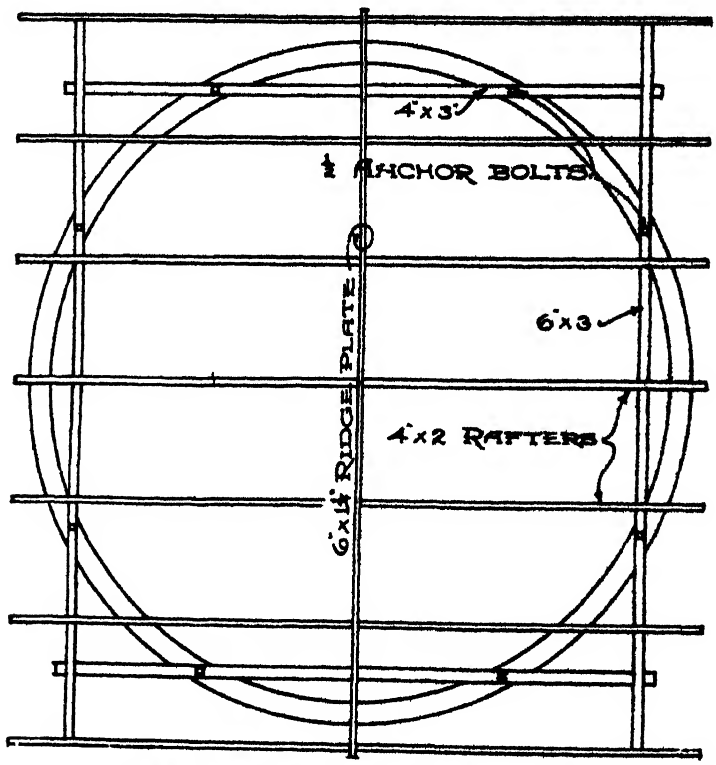


Fig 29.—Plan of Roof Frame for Concrete Block Silo.

The tensile strength of concrete at three months is computed to be not less than 200 lb per square inch, so that it would seem there should be no necessity for any reinforcement being put in Just how little may be safely used has never been determined, but as the quality of the concrete depends so much on the materials being used and the skill of the builder, it is recommended, as a measure of safety, that reinforcement be put in.

Where the silo is part underground, no reinforcement is necessary until within 12 inches or 18 inches of the surface.

In a silo 30 feet high and up to 16 feet in diameter the reinforcement may consist of ordinary No. 8 fencing wire laid continuously around the walls at 1½ inches from the outer face, and for the first 8 feet from the ground there should be double wires twisted together; over that height single wires will be sufficient, all spaced to about 8 inches apart.

For larger silos ⅜-inch steel rods should be used on the lower 8 feet, and then the twisted and single wires as before.

All ends must be hooked and lapped about 2 feet, where the wires are not continuous, and at all door openings the ends must be securely fixed to the upright rods, as shown on the plan of the block silo, Fig. 25.

In the block silo this reinforcement is laid in the mortar joint, and in the octagon silo (Fig. 32) pig-netting is used, tied to the upright rods and at the edges with tie-wire. It should be carefully noted that only sound wire should be used; rusted wire or wire that has had kinks straightened out should not be put in, nor should hoop iron be used.

Forms for the Walls.

The building of solid concrete walls requires some kind of form or mould to hold the concrete in shape until it sets.

There are on the market several types of all-steel plants, consisting of the moulds, hoist, scaffolding, and concrete mixer, all in one unit, but the cost is prohibitive except for a contractor or a firm which specialises in silo building. Steel or iron faced moulds are best, as they not only leave the face of the work with a better finish, but as no water touches the timber framing it does not swell or warp, and consequently the moulds wear better.

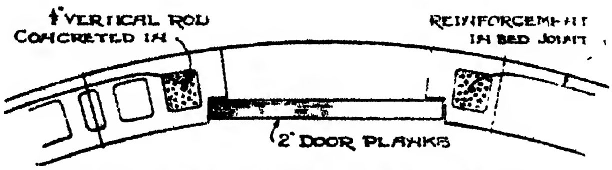


Fig 35.—Detail Plan of Door of Concrete Block Silo.

The quality of the timber used in these forms should be the best only, and clear oregon is recommended.

The forms for circular silos may be made in, say, eight sections, for each side of the wall (see Figs. 36 and 37). The depth may vary from 2½ to 4 feet; but 30 inches to 3 feet, the usual width of plain galvanised iron, is recommended as being the most useful. There must always be two forms, one for the outside and another for the inside (see A and B of Fig. 36), kept apart a distance equal to the thickness of the walls by means of spacing iron dogs (Fig. 37).

A double set of these forms can be used with much advantage, as in this way the builder can put in two fillings in the same day, rising the silo 5 or 6 feet. As soon as the first is filled, the second set is fixed on the top of it and the filling is continued. The work is then left until next morning, when the lower forms are raised over the top set and filled, and so with the next, as on the previous day.

The probable cost of these circular forms would be about £25 to £30 per set.

Every care should be taken to make these forms accurate, the tops and bottoms being correctly at right angles to the face, so that when they are set level on the tops the faces will be exactly plumb.

It will be noted on Fig. 37 that the mould is allowed to lap 4 inches on the concrete wall, and that the through bolt rests on the top of the concrete. This provision makes it easy to set the forms and to get them into position at each shift if only a single set is used, but where the double set is used, the lower set is always there to set the top one over, the two being bolted together through the top and bottom ribs.

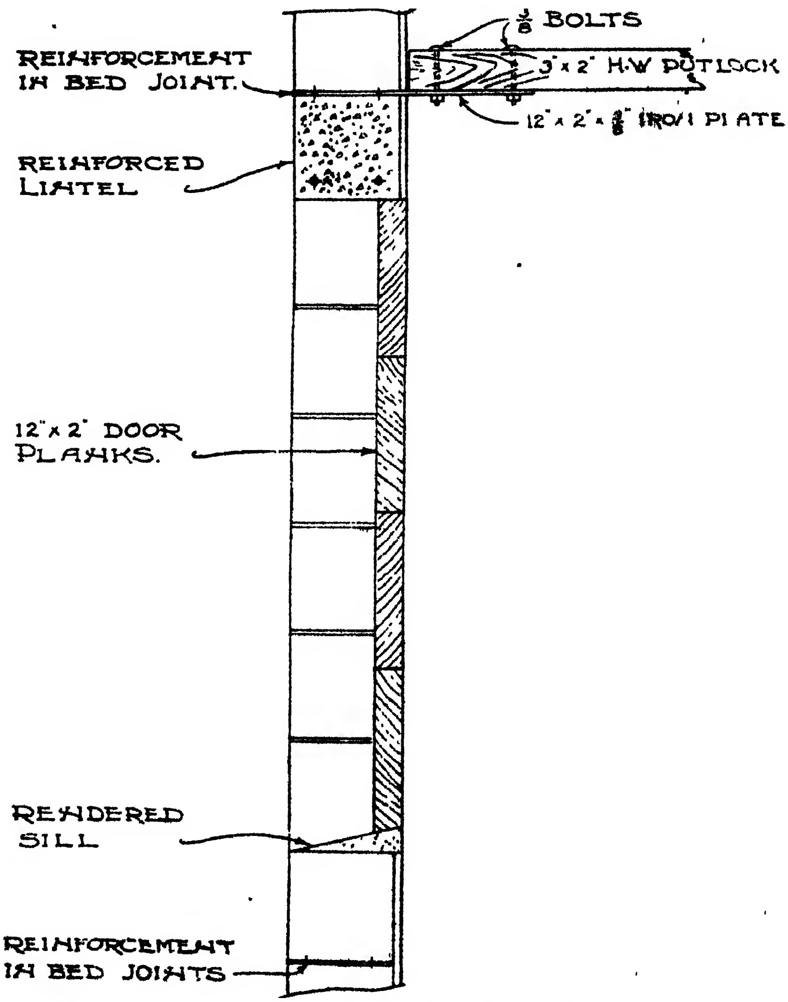


Fig 31.—Detail Section of Doors of Concrete Block Silo.

The moulds for the door openings (see Figs. 38 and 39) are made with 4 x 2 inch sides and top, and 6 x 1 inch sill piece, the latter set with a slope outwards to form a weathering sill on the concrete. The sides and top form a 2-inch rebate in the concrete to take the door planks, 2 inches thick, and the frame

must be made with a taper outwards, making it wedge-shaped, so that it can be easily removed when the concrete is set. One form for each door opening is necessary. For the block silo these rebated blocks are made by inserting into one end of the mould a piece of 2 x 2 inch wood to form the rebate in each block, the ends of which are made solid for this purpose. The heads of these door openings are made in one length, resting 8 inches at each end, as shown on the elevation of this silo (Fig. 27).

Moulds for the octagon silo are more easily provided, as only straight planks fixed together on batten ledges are required (see Fig. 33). To keep these in position, eight shaped upright angle posts are first set up inside the

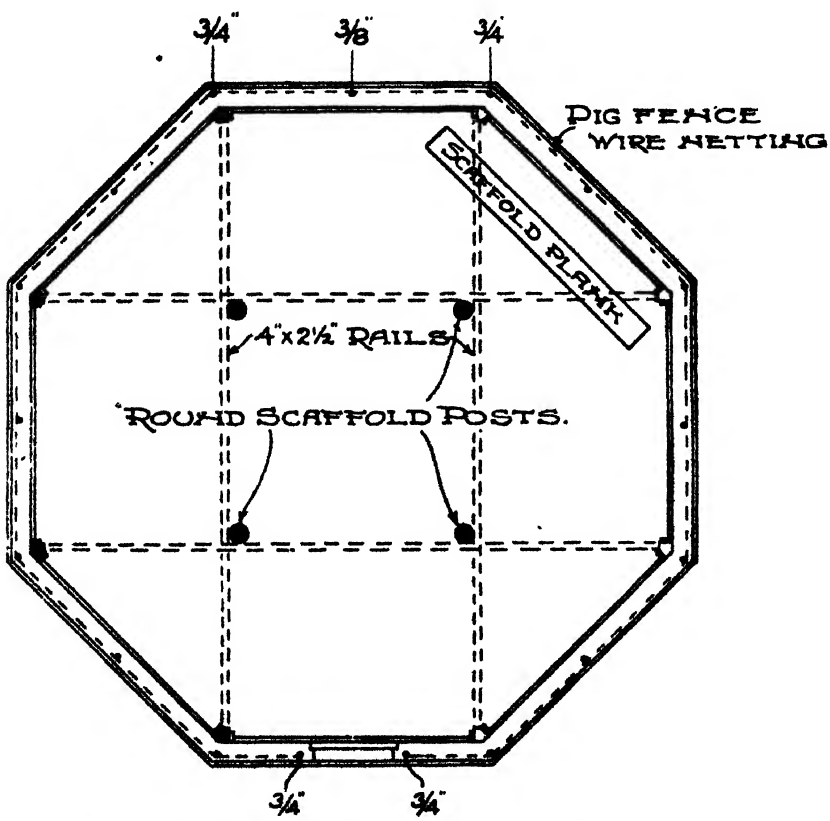


Fig 33.—Plan of Octagonal Concrete Silo, showing Framing for Concrete.

silo, and braced together at the tops with a batten and diagonally a few feet over the ground. These last are taken off when a few feet of the concrete has been built up. The forms may be made of four widths of 9 x 1 inch boards, held together by 3 x 1½ inch ledges.

The inside set have battens nailed across the ends, to fit against the sides of the upright posts, and these have two nail holes on each so that they may be temporarily held in position until bolted through to the outer forms (see angle post in Fig. 33). The outer forms are made in the same way, but the

ends are cut to mitre together over the edge of the upright, as shown. The bolts used have butterfly nuts to enable them to be easily turned with the fingers. The cost of these forms is very trifling compared with those for the circular silo, and they are much more easily applied.

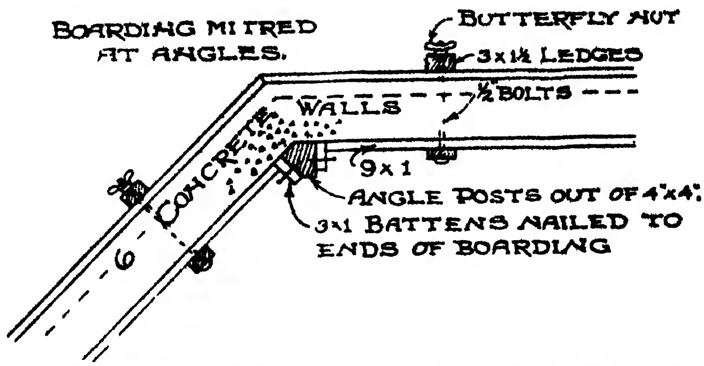


Fig 33.—Detail Plan of Corner of Octagonal Concrete Silo, showing Forms.

Of moulds for making concrete blocks, there are also several types on the market at prices ranging from £7 to £10, and also machines from £15 to £60.

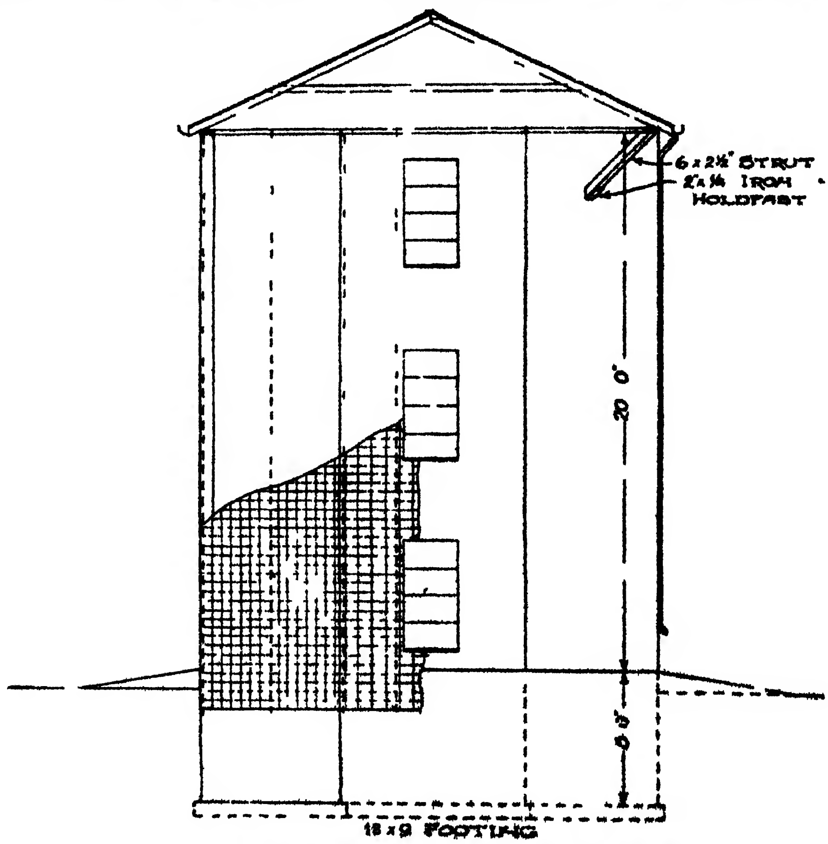


Fig 34.—Section and Elevation of Octagonal Concrete Silo.

A good mould can be made of wood, lined with plain galvanised iron or steel, the sides and ends held together with bolts or iron clips, made to remove easily. The best size of block is 16 inches long x 8 inches deep, and 8 inches thick, and having two holes about 4 x 4 inches through them. This leaves a 2-inch shell around the block, and a 2-inch web in the centre (see Fig. 26). The mould should be set on a board about 20 x 12 inches to take the bottom of the block, and on this the block can be carried away to where it is to be set for drying after the mould has been removed. The block should be left on this board for two or three days at least, when it may be taken off, and the board made available for use again.

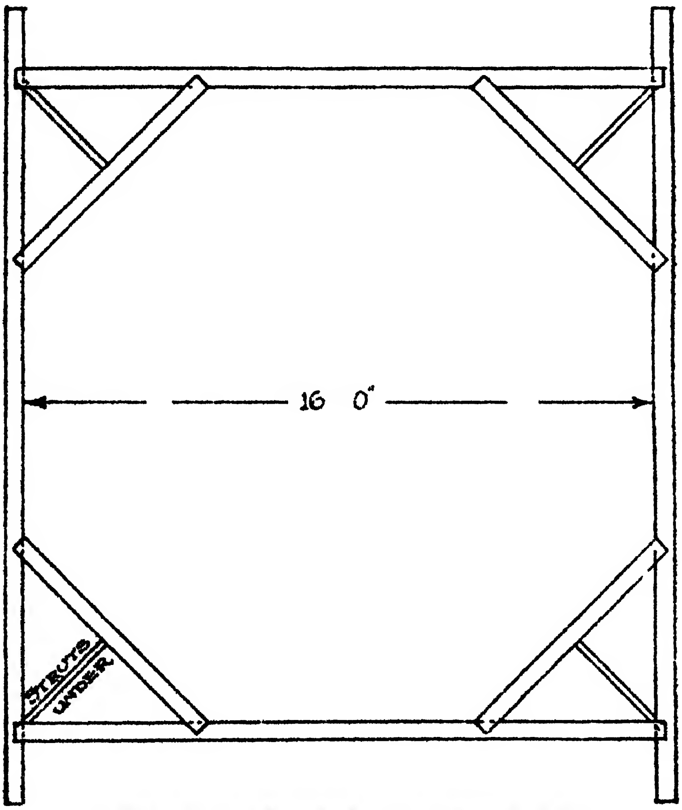


Fig 35. - Plan of Top Plates for Roof of Octagonal Silo.

The number of boards required depends on the number of blocks to be made each day. Having the holes in these blocks not only economises in material, but makes it much easier to handle them when they are being set in their places on the wall.

Filling the Moulds.

In filling the moulds of the circular silo, the concrete should be put in in layers about 8 inches deep, each tamped into place and levelled on the top, ready for the reinforcement to be placed. In the case of either silo, the

concrete should be packed against the moulds with the end of a spade, worked so as to get the fine stuff against the face of the mould. This will ensure a smooth face, which a brush over with liquid mortar will make smooth enough for a finish.

If it is intended to plaster the inside of the silo with cement mortar to a hard, smooth surface (and this is recommended), the concrete should be left more rough to give a good key for the plastering. The stuff in the centre of the walls should be packed with the end of a 3 x 1 inch batten. Light ramming is all that is necessary; the water will then rise to the surface of the concrete.

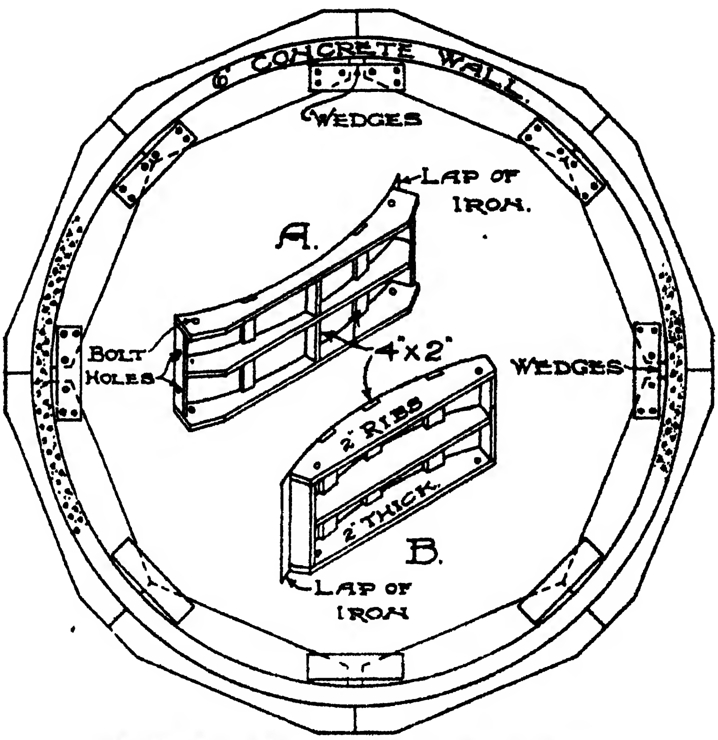


Fig 36.—Plan of Circular Concrete Silo, showing Forms.

When the forms are raised, and before the second layer of concrete is put in, the top surface of the concrete already erected must be well watered, and a liquid cement grouting of neat cement and water should be poured over it before the next concrete layer is placed. In filling the moulds for the concrete blocks the material should be well packed in layers about 2 inches deep, especial care being taken with the corners, so that they shall be properly filled.

Scaffolding.

As the work rises it becomes necessary to have scaffolding. This is most conveniently provided on the inside of the silo by setting up a centre pole a few feet higher than the silo, and sunk into the ground, or set in a cask

of earth or sand as a butt. To this pole eight ledges, about 13 feet long, may be lashed, the outer ends projecting through the walls 3 feet, to carry planks on the outside, and resting in holes left in the concrete walls for the purpose. These will be found the best support for foot planks for the operator. The holes can be filled in as the scaffolding is being taken down. The ledges are usually 3 x 2 inches hardwood. The inside scaffolding serves for the plastering of the walls. This should be done as soon after the concrete work is finished as possible, as a better bond is obtained if the concrete is still moist than if allowed to dry out. The outside planks are required when removing the outside forms and cleaning down.

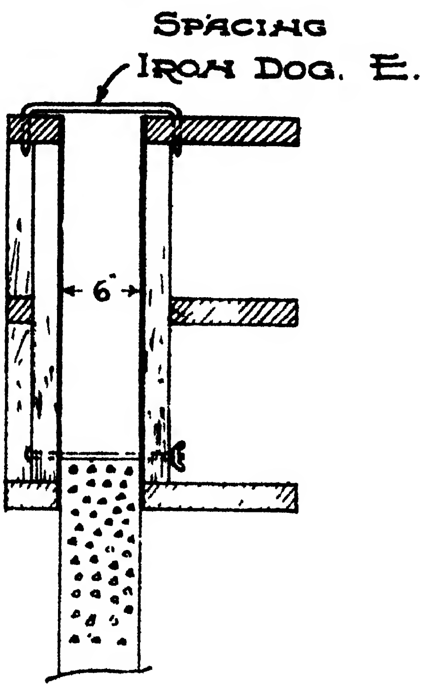


Fig 37.— Section of Wall, showing Position of Forms (single set).

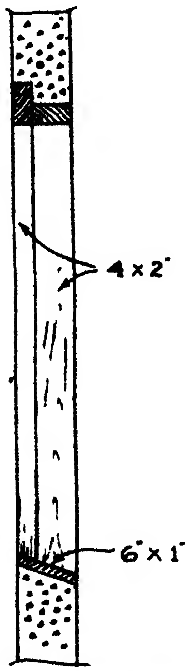


Fig 38.—Section showing Details of Frame for Door Openings.

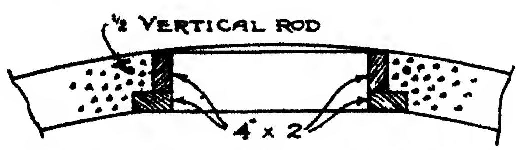


Fig 39.—Plan of Door Openings for Circular Concrete Silo.

To the top of the centre pole can be rigged a derrick, on the outer end of which a pulley block can be hung for the rope by which the concrete, &c., is hauled up. Usually a horse driven by a boy is employed for this work, and when done in this way a second pulley block is secured at the bottom of the silo wall as a lead for the rope to the horse. For the block silo, instead of the ledges going through holes in the wall, wrought iron straps $\frac{3}{8}$ inch thick, equal

to the thickness of the mortar joint, are bolted to the ends of the ledges (see Fig. 31), and these irons are set 2 inches on to the blocks. These are easily removed when lowering the scaffolding, and there are only the mortar joints to fill up, instead of the holes as before.

For the octagon silo, the ground plan (Fig. 32) shows four poles for the scaffolding, as the ends of the ledges can only be secured to the face of the angle posts by nailing short pieces of batten under each ledge. This frame makes the whole framing for the concrete very rigid and strong.

A Few Points to Remember.

With all buildings constructed of units, whether of stone, bricks, or concrete blocks, the units should not be placed in a dry condition on the mortar bed (especially where cement mortar is being used), as the block, brick, or stone readily absorbs the moisture out of the mortar and causes it to dry out too quickly.

It is a good plan in laying concrete blocks to keep a few set in a tub of water deep enough to cover them over, and to pass them to the builder out of the water. This is especially necessary in dry, hot weather, such a condition being the worst for all cement or concrete work.

When plastering a silo wall, or even if only giving it a coat of cement wash, the surface should be well wetted with a hose, if a sufficient water pressure is available. This stops the suction in the wall, and allows the cement wash to set slowly and harden. If it is not done it will be found that drying out it will easily rub off like dry powder.

As there are two holes in the blocks, it will be found difficult to spread the mortar quickly and without much waste. This can be more easily done by using a board ⅜ inch thick (the thickness of the mortar joints), 10 inches long x 4 inches wide, having two pieces nailed on the inner side just the size to fall easily into the holes in the block. This makes the surface of the block solid, and the mortar is easy to lay on.

When bending the wires round, weight them down at several points on the dry blocks to keep them in the correct position, and slightly raise them as the mortar is laid on, so that the wire will be properly embedded in the joint.

Do not neglect to keep the water supply up to the work in all cases, as much of the strength of the whole work depends on a liberal application of water.

Always keep the face of the moulds clean, and everytime they are shifted carefully rub down the face of each section. Should the concrete show any tendency to stick, smear the moulds with oil or grease. This also should be done when the moulds are being put away for further use. All bolts should be kept well oiled, especially on the threaded ends, so that the nuts will turn easily.

When the moulds are of timber only, the face next to the concrete should be dressed and painted, and oiled as they are used. This also applies to the moulds for the door openings.

Farmers' Experiment Plots.

Maize Experiments, 1922–23.

Upper North Coast District.

E. S. CLAYTON, Agricultural Instructor.

The following farmers co-operated with the Department in carrying out maize experiments during the season 1922–23:—

E. Amps, "Goldsbrough," Camira Creek.
A. Eggins, Grafton, Clarence River.
E. Green, The Risk, Kyogle.
R. W. Hindmarsh, "Wiaraga," Bellingen.
H. Johnson, Condong, Tweed River
M. McBaron, "Riverview," Raleigh, Bellinger River.
F. L. Playford, "Merrylands," Nana Glen, Orara River
H. Short, "Warawee," Dorrigo.
S. T. Walker, "Cranbrook," Deervale.

Experiments were also sown at Woodburn, Fairy Hill, Tatham, Tyndale, and Yorklea. The maize at Tatham, however, was completely destroyed by hail on the 23rd November, and comparative results were not obtainable at the other centres on account of the drought.

The Season.

A rather severe drought was experienced over most of the North Coast last season, and a great number of maize crops failed; this was particularly the case with the early crops. The early maize crops in this district are frequently affected by dry weather, while the late-sown crops, on account of the comparative reliability of the monsoonal rains of February and March, can generally be depended upon to give better yields. This season many crops of both early and late maize failed, and it was only on land that was well prepared, or in localities that happened to receive a few showers at critical stages, that fair crops were produced.

The dry weather was accompanied by high temperatures and drying winds, and during the greater portion of the season evaporation was enormous. The Dorrigo Plateau and the Bellinger River district received good rains throughout the year, and the season experienced there was much better than was the case elsewhere in the North Coast district, as the table on page 776 shows.

The Plots.

Kyogle.—Soil, fertile alluvial loam. Sown 18th October after 1 inch of rain, rows 4 feet apart, three grains dropped every 3 inches. The yields were very satisfactory at this centre, Fitzroy again proving most suitable.

Raleigh.—Soil, fertile alluvial loam; previous crop wheat for fodder. Sown 7th November; rows 4 feet apart, three grains every 3 feet. The application of superphosphate again gave a remarkable increase in yield; Large Red Hogan and Yellow Hogan gave the highest yields.

Bellingen.—Soil, fertile alluvial loam; previous crop potatoes. The trial was planted on 8th November in rows 4 feet apart, three grains every 3 feet. This experiment unfortunately was interfered with by parrots, and consequently the results do not accurately reflect the effect of the various fertilisers.

Condong.—Soil, fertile alluvial loam; previous crop maize. The trial was planted on 5th September in rows 4 feet apart, three grains every 3 feet. Early varieties were tried at this centre, Leaming giving the highest yield.

Nana Glen.—Soil, clayey loam; previous crop maize. The trial, which consisted of a fertiliser and a variety trial of early maize, was planted on 29th September; rows 4 feet apart, three grains every 3 feet. The land was harrowed one week after planting and cultivated as required between the rows to conserve moisture and destroy weeds, and was hilled on 7th November with sweeps on the single-horse cultivator. Mr. Playford took particular note, while threshing, of the percentage of waste in each variety of maize. On account of the season being dry, very little waste occurred, 7 per cent., which was found in the Boone County White, being the highest recorded.

RAINFALL.

Month	Dorrigo	Raleigh	Bellingen	Condong	Nana Glen	Camira Creek	Kyogle.	Grafton.
	Points.	Points.	Points.	Points.	Points.	Points.	Points.	Points.
Sept. ...	...	..	...	141 (from 5th).	.	...	...	...
Oct. ..	...	. .	.	636	272	135	32 (from 18th).	...
Nov. ..	Nil (from 21st).	169 (from 7th).	188 (from 8th).	528	60	149	45	...
Dec.	350	258	220	132	185	60	356	30 (from 14th).
Jan. ...	840	611	655	99	374	81	250	352
Feb. ..	226	298	210	...	296	163	44	100
Mar. ..	791	392	517	...	...	...	228	185
April ...	2,812	..	...	..	..	...	. .	753
Total ..	5,019	1,728	1,790	1,536	1,187	588	955	1,420

Deervale.—Yellow gravelly soil, of volcanic origin; elevation of site a little under 3,000 feet. The country is hilly and the soil variable, and check plots were used throughout the experiment to ensure more accurate results. The previous crop was maize. The trial consisted of a fertiliser and a variety trial, and was planted on 16th October; rows 4 feet apart, three grains every 3 feet.

All fertilisers gave substantial increases in yield; of the varieties under trial, Golden Nugget, which was the latest maturing, gave the highest yield.

Dorrigo.—Soil, red volcanic loam; previous crop maize. The trial was planted on 21st November. The rainfall was very erratic; good falls were experienced in December and January, but February was comparatively dry. The soil in this locality is extremely porous, and dries out with remarkable rapidity. In April 28 inches of rain were recorded, and caused considerable damage to the maize crops.

Camira Creek.—Soil, poor grey sand overlying a stiff clay subsoil. A fertiliser and a variety trial were planted on 29th September in rows 4 feet apart, two grains every 3 feet. Considering the adverse season and the nature of the soil at this centre, the yields are very satisfactory. All fertilisers gave substantial increases in yield. Of the varieties under trial, Golden Nugget and Bathurst Crossbred gave the highest yields.

RESULTS of Variety Trials (Late Varieties.)

Variety.	Kyogle		Raleigh.	
	bus.	lb.	bus.	lb.
Fitzroy	97	8	58	0
Yellow Hogan	80	0	61	0
Large Red Hogan .	88	32	65	40
Large Macleay Yellow .	62	48	32	14
Pride of Hawkesbury . ..	90	0	41	20
Ulmarra Whitecap ...	81	24	53	30
Golden Beauty	68	32	52	0
Manning Silvermine	85	40	47	18
Large White Horsetooth ..	44	16	30	0
Manning Pride ..	..		52	0

RESULTS of Variety Trials (Early Varieties)

Variety.	Condong		Nana Glen		Camira Creek		Dorrigo		Deervale.	
	bus.	lb.	bus	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Iowa Silvermine	70	10	39	30	34	28	37	45	36	0
Hickory King. ...	66	15	40	15	35	28	39	6	40	10
Golden Superb	64	0	49	3	...		45	35	40	10
Leaming	80	20	65	9	30	0	39	6	44	25
Early Clarence	45	0	33	38	......		...		......	
Boone County White... ..	60	0	52	0	...		....		......	
Eureka	66	35	....		39	14	......		...	
Funk's Yellow Dent	54	5	45	22	......		......		......	
Coodra Vale	78	40	49	3	...		.....		.....	
Craig Mitchell	......		54	10	......		....		.....	
Leggett's Pride	......		53	25	34	28	..		....	
Golden Nugget	......		52	40	40	14	54	42	45	50
Bathurst Crossbred	......		41	0	40	0	....		.....	
Early Morn	......		......		34	28	......		36	0
Goldmine	......		.		38	14	39	6	40	32
Brazilian White	......		......		31	28	.....		......	
Gold Coin	......		......		32	14	35	11	32	20
Small Red Hogan	......		......		......		39	6	44	11

Results of Fertiliser Trials.

Centre	Raleigh.		Bellingen.		Nana Glen.		Camira Creek.		Deervale.		Grafton.	
Variety	Fitzroy.		Ulmarra Whitecap.		Leaming.		Hickory King.		Leaming.		Fitzroy.	
Date Sown (1922)	7th Nov.		8th Nov.		29th Sept.		29th Sept.		16th Oct.		14th Dec.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Superphosphate, 1¼ cwt. per acre.	80	20	89	28	52	40	34	14	44	11	89	32
Superphosphate, 2½ cwt. per acre.	96	0	80	30	57	6	45	28	45	30	96	36
*M6, 2 cwt. per acre.	74	0	77	34	63	39	37	0	38	47	84	47
*M7, 182 lb. per acre.	43	0	96	36	54	51	35	0	48	12	80	8
*P7, 252 lb. per acre.	89	28	95	10	52	0	42	14	48	21	88	16
No manure ...	58	0	93	40	54	51	26	0	23	0	68	20

* The mixture P7 consists of equal parts of superphosphate and bonedust; M6 of superphosphate 5 parts and chloride of potash 3 parts; M7, of superphosphate 10 parts and chloride of potash 3 parts.

South Coast District.

R. N. MAKIN, Senior Agricultural Instructor.

Trials of varieties of maize were conducted on the farms of the following farmers during the season 1922–23:—

J. R. Shepherd, Bomaderry.
J. A. Martin, Pambula.
J. Timbs, Albion Park.
J. Chittick, Kangaroo Valley.
C. E. Prell, Gundowringa, *via* Crookwell.
C. Howard, Crookwell.

The Season.

From a maize-grower's point of view, the season proved one of the worst experienced for many years, owing to a very patchy rainfall. The plots at Albion Park, Kangaroo Valley, and Crookwell were so poor, as regards the setting of the grain, that they were cut for green fodder and fed to stock. Germination was good on the plots which were sown during October, good rain having fallen in September. The rainfall at Bomaderry gives a good idea of the weather conditions. It was as follows:—

September, 361 points; October, 149; November, 8; December, 163; and January, 278 points.

No fall of any value having been recorded from September on, it is really a wonder any grain set—indeed, many cases were noticed where crops failed to set any cobs, owing to bad pollination, the effect of the dry weather conditions. Rain at the time of tasselling of the cobs is very necessary for a maize crop.

The Plots.

The yields from the plots were very satisfactory, considering the conditions. The soil was alluvial river flats in every case, and had grown maize previously.

At Bomaderry the drills were 4 feet apart and the plants thinned to three stems every 2 ft. 6 in. apart in the rows. The plots were sown with the maize planter, and artificial manure (superphosphate and bonedust mixed in equal parts), was sown at rate of 2 cwt. per acre at time of planting. The crop received the usual chipping and scuffling to keep weed growth in check.

At Pambula the stand was on the square, hills 3 ft. 6 in. apart each way.

In the Pambula tests all the varieties were supplied by the Department of Agriculture, but at Bomaderry farmers in the district sent along varieties of their own choice to be tested alongside those of the Department. Samples of all of these when harvested and shelled were carefully taken and a moisture test made. The yields are based on this, the variety showing the lowest amount of moisture being used as a basis for calculation. The earlier maturing varieties generally show a lower percentage of moisture on account of being riper.

Comments.

The test in which the farmers varieties were tried against those sent by the Department of Agriculture attracted a good deal of interest. Large Red Hogan came out on top, yielding 97 bus. 46 lb. per acre; and Funk's Yellow Dent came second, with 96 bus. 36 lb. per acre. In last year's test at Bolong, only a few miles away, Funk's Yellow Dent was first with over 149 bus. 44 lb. per acre, and Large Red Hogan second with 121 bus. 31 lb. per acre. It will be interesting to see now they yield in the coming season.

Funk's Yellow Dent has much to commend it as a grain-yielder where conditions suit—note the difference between its moisture content and that of Large Red Hogan. Fitzroy is holding up well. Last year it yielded 105 bus. 13 lb. per acre. but was not so well placed as this season. Boone County White did well again; last year the yield was 109 bus. 43 lb. per acre. Those who like white maize should give this a trial. The seed was originally imported by the Department of Agriculture from the United States of America. Of the other varieties two samples of good looking grain came from Mr. W. H. Cox, Kangaroo Valley. In harvesting the plots, it was noticed that there were some cobs missing from the section sown with P. Daley's Large White Horsetooth, but the loss was not sufficient to influence the yield to any great extent. It was also noticed that the cobs of Reid's Yellow Dent sent from Pambula were infested with weevil.

It will be seen on glancing at the yields from the Pambula plot that Silvermine is at the top. This is a variety which has been popular in the Bega and Pambula districts for many years, and, like Hickory King, is changing;

in its character. A comparatively new variety, Coodra Vale, is second, with a yield of 84 bus. per acre. This variety yields a cob with a fairly thick core and a short grain; it will need further tests and to be brought under a moisture test before it can be compared with other varieties.

Results of Variety Trial at Pambula.

Variety.	Yield per acre.		Variety.	Yield per acre.	
	bus.	lb.		bus.	lb.
Silvermine	89	0	Large White Horsetooth ...	70	0
Coodra Vale	84	28	Yellow Hogan	68	28
Leaming	77	0	Boone County White	65	42
Large Red Hogan	77	0	Pride of Hawkesbury	64	28
Goldmine	76	0	Fitzroy	61	
Funk's Yellow Dent	75	0	Manning Pride	60	28
Golden Beauty	71	0			

Results of Variety Trial at Bomaderry.

Farmer's Name.	Variety.	Yield per acre.	Farmer's Name.	Variety.	Yield per acre.
		bus. lb.			bus. lb.
Department of Agriculture.	Large Red Hogan.	97 46 (17·4)	E. Watts	Giant White	78 21 (14·1)
J. R. Shepherd, Bolong.	Funk's Yellow Dent	96 36 (12·8)	Department of Agriculture.	Golden Beauty	75 24 (14·2)
Department of Agriculture	Fitzroy	87 12 (18·4)	J. Horgan, Bolong	Goldmine ..	75 2 (13·9)
J. Chittick, Kangaroo Valley.	Boone County White.	87 12 (13·0)	Department of Agriculture.	Large Macleay Yellow.	74 47 (19·2)
Department of Agriculture.	Yellow Hogan ..	86 2 (16·3)	J. H. Morschel	Goldmine	74 14 (14·0)
W. H. Cox, Kangaroo Valley.	Yellow Horsetooth .	84 48 (16·8)	Department of Agriculture.	Leaming	72 27 (13·3)
,, ,, .	Yellow Mastodon	83 38 (18·0)	P. Daley, Bolong	Large White Horsetooth.	71 50 (14·2)
J. A. Martin, Pambula.	Reid's Yellow Dent	79 31 (12·8)	M. Donnelly, Kangaroo Valley	Hickory King ..	58 19 (11·6)
H. Oke, Bomaderry.	Giant White ...	79 31 (13·4)			

The figures in brackets below the yield per acre denote the actual moisture content of the variety.

Experiments for the Control of Bunt.

Fungicide experiments have been conducted to test the most reliable and economical method of treating seed wheat for the prevention of bunt. Three treatments—copper sulphate (1½ per cent. solution), copper carbonate, and a proprietary Burgundy mixture were tested against non-treated seed. In both sections copper carbonate gave the highest return per acre and also proved its capability of destroying bunt spores.—H. Ross, Manager, Wagga Experiment Farm.

Irrigation Farming in New South Wales.

GROWING CEREALS FOR HAY AND GREEN FODDER.

[Continued from page 696.]

A. N. SHEPHERD, Senior Agricultural Instructor.

HAVING considered the lay-out and preparation of the land, and the systems of irrigation that may be adopted, we turn to the consideration of the crops which the land is to produce. On the Murrumbidgee Irrigation Areas dairying and fruit-growing have so far chiefly divided farmers' attention. As to the latter it may be said at once that it is not proposed to deal with it here, and we proceed therefore to discuss the production of fodder crops.

Up to the present the growing of hay has chiefly been of interest to dairy-farmers, but with the larger areas thrown open by the Commissioners in the last few years, and the general development of all activities in the district, the possibility of it becoming profitable to grow hay for sale presents itself. Orchardists, too, are unable to devote time or area to the production of fodders for their livestock, and there is consequently growing up a local demand for this product, in the satisfaction of which an increasing number of settlers will find their livelihood. The question of the provision of fodder, such as lucerne hay or chaff, for other parts of the State is certain also to present itself, so that the opportunities for men finding employment in this sphere are certainly developing.

Wheat and oats are the crops most grown for hay purposes, and it is convenient to discuss the methods of handling them first.

Wheat for Hay.

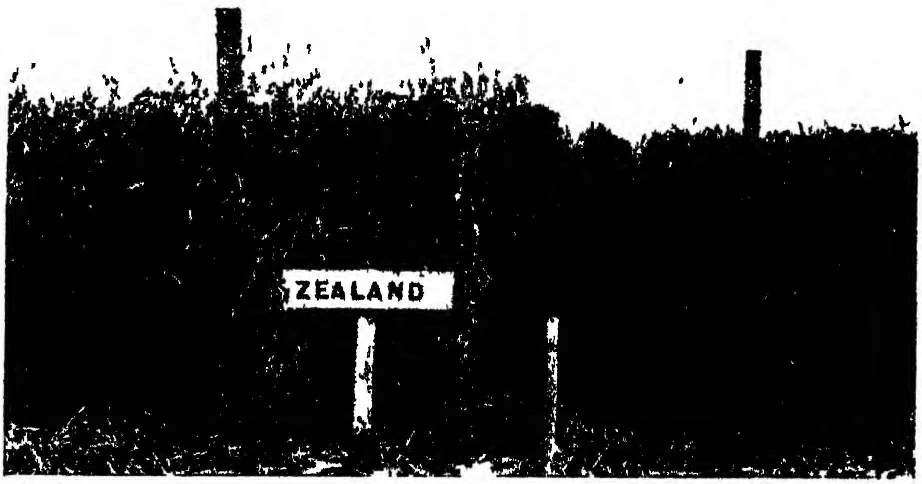
The soils suitable for wheat vary from red loams to heavy grey soils. A short fallow is advisable before sowing, which means that before planting new land ploughing should be done in December or January, and in the case of old land as soon as the previous crop is off. The object of this fallowing is not the conservation of moisture as in ordinary wheat districts, but the sweetening and mellowing of the soil and the destruction of weeds.

If possible, it is an advantage to plough dry at this stage, though under extremely dry conditions it may be necessary to resort to irrigation before putting the plough in.

The land should then be worked down, and in the case of new ground grading and check-bank making should be carried out. It should be remembered that too much care cannot be given to the preparation of the land. Any labour at this stage will be amply repaid. A few farmers on the areas irrigate their crops without previously grading and making the banks, but the

unsoundness of the practice is very clearly demonstrated by the patchy waterings that result, despite the great deal of labour that may be expended in making the water run freely, and all the shovel work that may be required to push it over high places. Uneven in growth and in maturity, the ultimate crops also advertise the unsatisfactoriness of these rough and ready methods. Thorough command of the water is as necessary with these as with any other crops

Providing the season is not a wet one, it is essential to water the land before sowing, and it should be done in April in order to give the land a chance to dry before sowing in May. Under no conditions should the seed be sown and the land irrigated afterwards, as that usually results in the seed rotting, or the surface soil caking, and in either case a very poor germination.



Zealand, early sown. Yield, 3 tons 19 cwt. 10 lb of hay per acre.

After being irrigated, the land should receive a thorough but shallow cultivation On no account should the working at this stage be deep. If weeds are present, the disc-cultivator, if available, is the best implement, but otherwise a spring tooth or a fixed-tine cultivator is suitable. Care should be taken not to allow the land to dry out before drilling, and the seed should be sown in moist soil to ensure a quick and even germination. If the soil is in good condition at the seeding very little will be gained by harrowing after the drill, but if the land is rough or the seed is being poorly covered, it is advisabl to harrow.

It is usual to drill the seed in at the rate of about 60 lb. per acre, except with poor stooling varieties like Firbank, which should be sown at 70 to 75 lb. per acre. The varieties most suitable for the Murrumbidgee Irrigation

Areas are Zealand, Yandilla King, and Gresley. The last, being an early wheat, should be sown later than the others—say up to the middle of June. Firbank is also useful for hay, but is being steadily displaced by the new wheat, Gresley, which stools better, has a stronger straw, and has about the same period of maturity. A dressing of 70 lb. of superphosphate per acre is always found very profitable.

If the crop is too forward and the land is firm, the crop can safely be fed off, and will still return a good yield, but feeding-off should be done early and never be left until the crop "spindles." Under no circumstances should stock be put on the land when it is wet or irreparable damage is likely to be done both to the soil and to the crop itself. When the stock have been removed, run a harrow over the crop to break up the surface again. A few

Yandilla King, early sown. Yield, 2 tons 16 cwt. 11 lb of hay per acre.

plants may be pulled up, but the crop will derive more advantage than that. It is an old adage, "Let him that harrows not look behind." The feeding-off of the crop delays its maturity, but, judiciously done, it may improve the stand. It is always better to put a fair number of sheep on for a short time than a few for a longer period.

Should the season prove unfavourable, a spring watering is advisable, but with normal seasons the crop will usually mature and give a good return without the second watering.

The crop should be cut "off the flower"—*i.e.*, just when the flower is falling. This results in a good-coloured chaff with practically no grain. The crop is cut with a reaper and binder, and stooked in large round stooks, in which, in dry weather, it should cure in about ten to fourteen days. The

round stooks stand up to the weather well, resisting wind and keeping out the rain. The hay should be carted and stacked as soon as it is dry, which can be ascertained by an examination of the centre of the sheaves inside the stook. The knots of the straw should not contain moisture, but should show signs of withering and shrinking, and the straw, if taken in two hands and given a circular twist, should break, without, however, being too brittle. The practice of chaffing from the stook is not to be commended, and is only justified in the case of very high prices and plenty of labour being available. If it is adopted, care must be exercised to see that the chaff does not heat in the bags.

Great care should be taken in the stacking. The site should be as near the road as possible, and a high piece of land should be selected if available.

Hay grown with one irrigation before sowing, Yanco Experiment Farm.

The stacks should be protected against the chance of irrigation water getting at them by throwing a bank round them, say a couple of chains away. The centre of the stack should be kept well-filled and a good top put on. It is essential that all sheaves slope outwards, so as to prevent water entering, and to give an outward turn to any rain that may beat in. Much good hay is lost in the stack through neglect in this respect.

The climate of the Murrumbidgee Irrigation Areas is so hot and dry that steaming of the hay is necessary to ensure a good sample of chaff, otherwise the hay, being brittle, splits up very fine, and a very uninviting chaff is the result. The length of the chaff depends in a measure on the fineness or coarseness of the straw, but in very few cases will the grower be called upon to do his own chaff-cutting, as in most instances the contract machine does the work.

Second-hand bags, unless in very good order, are a poor economy by reason of the loss of a favourable impression on the buyer, and the loss of chaff through the holes in the bags. New bags, as a rule, contain more chaff for the reason that they will stand being packed.

It is well to take precautions against the chaff getting wet if the weather is doubtful, as dampness or rain produces mould.

Oats for Hay.

The preparation of the land for oats requires to be carried out on similar lines to that for wheat. Heavier land may be said as a rule to be more suitable to oats than to wheat. It is usual to sow about 1½ bushels per acre of varieties such as Algerian and Guyra, but with a poor stooling variety like Sunrise it is advisable to sow up to 2 bushels.

Firbank, early sown. Yield, 3 tons 3 cwt. 1 qr. 2 lb. of hay per acre.

For hay, Algerian holds pride of place. It can be sown over a long period, say from May till the middle of July. For late sowing, the quicker maturing varieties, such as Sunrise or Mulga, are suitable.

The use of fertilisers greatly assists this crop, and an application of superphosphate at the rate of 70 lb. per acre with the seed will amply repay the outlay.

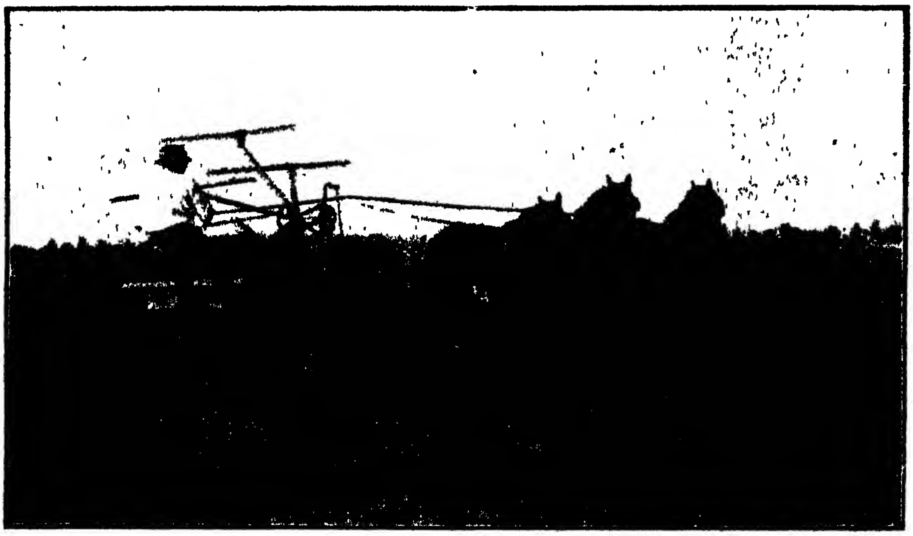
Feeding off, where possible, should be carried out as with wheat. Harrowing after the removal of the animals is a good practice, and the yields can be greatly increased by giving an irrigation in the spring. In some cases, even a second watering has been found advisable.

The oat crop should be cut for hay just as the heads are turning. This results in a chaff of good colour, and it is also claimed that at this stage the oat has lost its bitter taste. The methods of harvesting, and the subsequent treatment of the crop until it is bagged, are similar to those described for wheat.

Cereals for Green Feed.

The cereals about which we have been talking may also be profitably grown for green winter fodder, either separately or in conjunction with a legume such as vetches or field peas. The legume vastly improves the quality of the fodder, giving a more balanced ration as well as greater bulk.

The land should receive the same treatment as for a hay crop, though earlier preparation is essential to allow of earlier sowing. The irrigation previous to sowing must be thorough, as there must be sufficient moisture in the soil to carry the resultant crop so far that if another watering is necessary before winter the crop shall have made sufficient growth to resist injury from the watering. As a matter of fact, this watering of the crop is necessary in most seasons.



A Crop of Skinless Barley on the Areas.

Drilling is usually done in March in the way already described, the rates of seeding being 60 lb. for wheat (or if Firbank is used, then 90 lb.), oats $1\frac{1}{2}$ to 2 bushels, according to variety, barley and rye 60 lb. each. Where a legume is being sown in conjunction it is usual to use 15 to 20 lb. of the legume in addition to the cereal.

Superphosphate at the rate of 70 lb. per acre applied with the seed results in an increase in yield that more than pays for the cost of the application.

After drilling, it is a very good practice to run over the land an inverted harrow weighted with a log of wood. This packs or compresses the soil round the seed, greatly assisting germination, and preventing many plants from perishing as the result of a loose open seed-bed at a period of the year when the heat rapidly dries the soil. The loose soil, falling over the bars of the harrow, at the same time leaves a soil mulch on the surface which prevents excessive evaporation.

In some instances the roller has been used with the object of compacting the soil on the seed, and the results are sometimes good, but evaporation from the surface so created is very great. For later watering, too, a flat surface such as the roller leaves is not satisfactory, the water running over the land instead of percolating into it, and, again, this fine surface compacts with watering or with rain into a set, cement-like surface that is very undesirable.

The crop should be available for grazing about 1st June, or as soon as there is sufficient growth to warrant its use, and for cutting from the middle of July. In the case of wheat and oats two cuts can be taken off, or, if preferred, the second can be allowed to go for hay. Barley should be fed before the crop becomes too forward, as the awns on the head are liable to cause trouble to the stock if allowed to become too hard. The straw of rye becomes very hard and wiry as it matures, so this crop also should be fed before it is too forward.

A certain amount of care should be exercised in feeding rye to dairy cattle, owing to the liability of the crop to become infected by ergot and the danger of the ergot causing abortion in the cattle. In grazing green crops it is wise to turn the stock in for a few hours only each day. This saves a great deal of the crop by preventing the cattle from treading it down, as once the cattle have had a "fill" they walk round the crop, only taking a mouthful here and there, and destroying much of the fodder. But cutting is a much better method than feeding off. It is more economical of the fodder, and it also preserves the land in better physical condition. Cutting is usually done with the scythe or the mower. If with the latter, sufficient for two or three days only should be cut at one time. It is always advisable, if possible, to feed the cut fodder in a feeder, and not to throw it on the ground, as there is apt to be a good deal of loss in the latter case.

(To be continued.)

FODDER FOR SHEEP.

DURING his recent visit to this country, Professor Stakman, of Minnesota, U.S.A., remarked on the universal reliance on natural pastures for sheep. No doubt conditions are different in America, but even in Australia the holdings are getting smaller, and contemporary with that change the discovery is being made that crops can be profitably grown for fodder and the carrying capacity of the small farm thereby increased.

Most sheep men will admit that oats are unsurpassed for sheep, and oaten hay is superior to wheaten hay. We now have varieties of oats that will grow in districts quite unsuited for maize—in fact, on any country that will grow wheat, and it may be expected that oats will become increasingly popular as their value and cheapness becomes known. In Canada a greater bulk of oats than of wheat is annually produced, and, though we have not to house stock and feed them through the winter, a supply of locally grown feed at a time when the animals have to range over bare pastures would be most valuable. Nor is it only a question of drought. There are the shorter periods of scarcity that occur nearly every year. Oats would furnish a simple solution of many such periods, and would improve the staple of the wool. —J. T. PRIDHAM, Plant Breeder.

Maize for Cornflour.

H. WENHOLZ, Special Agricultural Instructor.

WITH a view to stimulating the local manufacture of cornflour, the Minister last year approved of a contest being carried out with the object of determining the best strains of Hickory King maize available. It was arranged that the competing strains of seed should be sown on three selected farms (one each on the North, Central, and South Coast) having land as uniform as possible. Messrs. Clifford Love and Co., cornflour manufacturers, kindly donated prizes amounting to £10 10s.

The results of the contest, with the yields on the three plots and the averages in order of merit, are as follows:—

Competitor	North Coast.		South Coast.		Central Coast.		Average.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
H. Cole, Pambula ...	27	18	59	26	57	6	47	54
J. P. Rily, Cobargo ...	39	26	48	50	49	5	45	46
J. Bartley Pambula ...	24	29	57	17	51	55	44	34
H. C. Flett, Taree ...	36	24	52	48	41	41	43	38
R. Richardson, Tinonee ...	24	16	56	46	49	44	43	35
A. Short, Dorrigo ...	33	24	46	51	49	5	43	8
P. H. Smith-Weston, St. Mary's	34	0	52	11	41	41	42	36
J. Booth, Kempsey ...	33	24	47	32	43	11	41	22
A. Jeffrey, Kempsey ...	33	10	47	32	41	0	40	33
W. Powers, Pambula ...	20	30	44	15	54	51	39	51
C. Lean, Taree ...	18	12	53	29	46	48	39	30
C. E. Drury, Taree ...	18	12	44	15	55	36	39	21
C. Haigh, Pambula ...	18	16	44	15	51	55	38	10

The winner of the contest was therefore Mr. H. Cole, of Pambula, Mr. J. P. Rily, of Cobargo, being awarded the second prize. Mr. Cole's prizes included those for the best yields on the South and Central Coast plots as well as that for the best average, while Mr. Rily's prizes comprised those for the second-best average and for the best yield on the North Coast. Mr. Cole's sample of Hickory King was a little different to the usual type, having a larger core and a larger cob with very thick grain, which should be well suited for the manufacture of cornflour.

The yields were not, of course, so high as in other maize contests, the object of the contest being merely to find the best yielding strain of Hickory King, which is recommended more for second-class maize soils on the coast, on which class of soil the plots were therefore located.

Seed Maize Contest.

HAWKESBURY DISTRICT, 1922-23.

E. A. SOUTHEE, Principal, Hawkesbury Agricultural College.

A seed maize yield contest was inaugurated during the season 1922-23 in co-operation with the Hawkesbury District Agricultural Association.

Entries were limited to the Large Red Hogan variety, otherwise they would have been much more numerous, but as it was, thirteen entries were received, two of which were from growers in the Manning River District. The samples were inspected by Mr. H. Wenholz, and were pronounced of high-class quality.

The Plots.

The contest was carried out at Hawkesbury Agriculture College River Farm on alluvial loam, which had borne a crop of maize the previous year. The stubble was ploughed under on 14th June, 1922, harrowed and cross-harrowed on 20th August, reploughed and cross-harrowed on 27th September.

Planting was carried out on 28th September, using a maize dropper, the rows being 4 feet 6 inches apart, and three grains were planted about every 32 inches.

The mixed fertiliser P7 (equal parts bonedust and superphosphate) was applied at the rate of 1¼ cwt. per acre.

Each plot was one-fifth of an acre in area. College seed, sown every alternate plot, was used as a check.

After-cultivation comprised rolling, harrowing, spring-tooth cultivating, hand-cultivating, and hilling.

The Season.

The season 1922-23, will be remembered in the district as one of the worst on record, many farmers finding it necessary to cut considerable portions of the maize crop as green fodder.

The rainfall during the growing period (records taken at the College) was as follows :—

September 28th to 30th, nil ; October, 145 points : November, 54 points ; December, 144 points ; January, 277 points ; February, 33 points (lowest rainfall ever recorded at the College for month of February) : March, 185 points. Total, 838 points.

In addition, the continued hot windy weather during the summer months contributed to the low yields, and under the circumstances the yields shown in the accompanying table must be considered satisfactory.

YIELDS of Hawkesbury District Maize Contest.

Competitor	Yield	
	bus.	lb.
Hoskisson, S. H., Richmond ...	65	51
Greentree, J., Freeman's Reach ...	62	21·5
Hannabus, L. W., Windsor ...	61	11
Griffiths, J. C., Freeman's Reach ...	59	22
Ryan, —, Freeman's Reach ...	59	19
Longworth, A. R., Manning River ...	58	5·6
Rosenthal, L., Freeman's Reach	57	19·5
H. A. College (average of check plots) (non-competitive) ...	56	29
Charley, P., Richmond ...	56	3·6
Caterson, W., North Richmond ...	55	46
Holland, P. A., Freeman's Reach ...	55	39
Smith, J. W., Richmond ...	55	27
Levick, G. E., Manning River ...	54	32·7
Bland, A. A., Castlereagh ...	53	

NOVEMBER WORK IN THE APIARY.

IN the majority of localities it is usual for the colonies to be very progressive during this month. The honey flow will be commencing in a good number of places, and much care will have to be exercised to prevent excessive swarming. Later, when the flow is fully on, the bees appear to be more engaged with gathering supplies, and swarming ideas slacken down considerably.

Where these progressive conditions obtain, artificial increase and queen rearing may safely be practised. It is advisable to practice modern methods, but there is no need, nor is it advisable, to overdo the matter and seriously interfere with the welfare of the established colonies. Many bee-farmers are slow at making an attempt to adopt modern methods, but it is just a matter of having patience, and not becoming disheartened at a few failures. A good deal is said regarding these important matters in the Departmental literature, and if the advice is followed carefully and the operations are carried out during progressive times, even the more serious manipulation will soon be found easy.

Should extracting work be going on, see that the honey is well ripened (sealed) before extraction. There is no loss in production in getting the honey sealed if sufficient supers are available, and during a honey flow an effort should always be made to get a good number of supers of new combs built out from comb-foundation

While a good look-out for disease in the brood nest should be maintained at all times, it is advisable that when progressive conditions obtain a special examination should be made early, for treatment can be effected immediately, probably without loss. The matter of brood diseases is fully dealt with in Departmental literature.—W. A. GOODACRE, Senior Apicultural Instructor.

Boys' Maize-growing Competitions.

H. WENHOLZ, Special Agricultural Instructor.

In recent years much interest is being taken by agricultural societies and branches of the Agricultural Bureau of New South Wales in boys' maize-growing competitions. In some cases instructors of the Department have assisted in the judging, and the experience has been valuable in determining the best methods of conducting these competitions.

It must be said first of all that boys' competitions in which the prize is given straight out for the highest yield of maize per acre are not favoured by the Department as a desirable form of contest. In such a contest the winner has been known to possess a particularly rich piece of land, by no means typical of the district, and the result has been to discourage other competitors and the main objects of the competition have been lost.

There are at least three well-recognised methods of increasing the yield of maize—soil improvement, better methods of cultivation, and better methods of seed selection. Any agricultural society which is honest in its endeavour to promote agricultural betterment and to stimulate progress in its district should take these three factors into consideration in framing conditions for conducting a boys' maize-growing competition.

The following scale of points for judging such a contest was successfully used by the Milton branch of the Agricultural Bureau (South Coast) last season:—

Yield of plot	50 points.
Cultivation methods and written record	30 ,,
Quality of seed maize (ten selected ears)	20 ,,
Total	100

When a competition is judged on these lines the boy who is not favoured with exceptionally good land may, by adopting better methods of cultivation and seed selection, have a good chance of securing the prize before a competitor who has obtained a high yield on good land, but who has not devoted so much attention to cultivation and seed selection.

The judging of the cultivation methods and written records of the boys should be done on the spot preferably during the growth of the crop, any time after the last cultivation. It is necessary to see the exact conditions under which the crop is grown to allot the points for cultivation, for the best methods must differ according to the circumstances of location, soil, and season. At this time advantage may be taken of the opportunity to give the competitors general advice for still further improving their yields. The Department is willing to assist in this judging as far as possible.

The yield of the plot should be supervised by a local committee appointed for the purpose, and the points for the seed sample of ten ears selected from the plot should be given at a local evening at which the exhibits are shown together and some advice given to the boys on the selection of seed.

The Milton branch has just completed a boys' maize-growing competition conducted on these lines, and deserves considerable credit on its successful issue.

For the benefit of other societies and agricultural bodies, the following conditions for a boys' (and girls') maize competition are suggested:—

1. The competition should be open to all boys and girls under 18 years of age.

2. Applications should reach the secretary not later than a certain date, giving (*a*) full name and address, (*b*) age at last birthday and date of birth.

3. The area should be a tenth, an eighth, a quarter, half, or any convenient portion of an acre, and each competitor should be allowed to choose his own land and methods of preparing the soil, planting, and cultivating the crop.

4. Any variety of maize may be used by the competitor.

5. Only one entry should be allowed each competitor.

6. The time of sowing should be restricted to one month—that generally most suitable for the district.

7. Within a week from harvesting each competitor should select, without help, ten ears of maize from his crop and forward them to the secretary.

8. Competitors should notify the secretary when the crop is ready to harvest.

9. No competitor should be allowed to employ any labour on the competition plot other than his own personal labour, except in ploughing or the driving of horses, for which help may be necessary.

10. Such competitor should be required to keep a record showing the dates and particulars of the different operations on the plot, the kind of soil, previous cropping of the land, manure or fertiliser applied, dates and depths of ploughings, implements used in subsequent preparation of the seed-bed with the dates of cultivation, date, and method of planting, variety of maize, source of seed, distance between rows and grains in the row, subsequent harrowings or cultivations, with the dates and types of implements used, and the incidence and the amount of the rainfall.

ROTATION TRIALS AT WAGGA EXPERIMENT FARM.

The rotation experiment comprises fifteen 1-acre blocks in which various rotations of fallow, wheat, and peas are being tested. Good average yields were obtained last season, and some striking contrasts were shown in the results. The most outstanding was the fallow plots compared with plots which have grown wheat two years in succession. The fallow plots gave a yield of 26½ bushels per acre, being just double that of the non-fallowed plots.—H. ROSS, Manager, Wagga Experiment Farm.

Depasturing Experiment.

GLEN INNES EXPERIMENT FARM.

J. N. WHITTET, Agrostologist.

The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw attention to the fact that final conclusions cannot yet be drawn from these trials as they have only been conducted for two years. The facts are published now, it being recognised that the public are entitled to know the results obtained so far.

A DEPASTURING experiment is being conducted at the above farm with the object of ascertaining—

(1) The carrying capacity of various grass mixtures.

(2) The palatability of the different grasses.

(3) Their respective grazing values.

(4) Their respective effects on the condition of sheep pastured thereon.

(5) A comparison with the value and effect of natural pasture.

The land selected for the experiment was divided into two plots which received identical preparation for sowing, the seed being sown in March, 1920. The area of each plot was 4 acres.

Plot 1. Toowoomba Canary Grass (*Phalaris bulbosa*), 8 lb., and White Clover (*Trifolium repens*), 4 lb. per acre.

Plot 2. Cocksfoot (*Dactylis glomerata*), 12 lb., Perennial Rye (*Lolium perenne*), 15 lb., and Cow Grass Clover (*Trifolium pratense* var. *perenne*), 6 lb. per acre.

The germination of all seeds was excellent. From October to December, 1920, seven months after planting, equal numbers of sheep were turned in on each plot to prevent the growth from becoming rank.

The experiment proper was commenced on 1st January, 1921. On each plot were depastured two-tooth wethers of the following crosses :—Three Merino x Lincoln–Lincoln–Merino, three Merino x Border Leicester–Border Leicester–Merino, three Merino x Romney–Romney–Merino There were thus nine sheep on each plot, equal to 2¼ sheep per acre. These sheep were weighed before being placed in the paddock, and at intervals thereafter.

It may be explained in connection with the crosses named here and the symbols in the tables, that in each case the breed mentioned first is that of the ram last used in the cross. The symbol L_1 signifies Lincoln, the symbol L_3 signifies Border Leicester, and the symbol L_4 signifies Romney Marsh.

Arrangements were made for a convenient and adequate water supply, and a salt lick was also available consisting of Liverpool salt, 40 parts, bone meal, 5 parts, and sulphate of iron, 1 part. On 15th March and 19th April, the sheep in both paddocks were drenched for stomach worms at the same time as the rest of the farm flock.

PLOT I.—*Phalaris bulbosa*, 8 lb., White Clover, 4 lb. per acre. Area, 4 acres.

Periodical Weights of Sheep in 1921.

Cross.	1-1-21	20-1-21	31-1-21	23-2-21	30-3-21	27-4-21	21-6-21	25-7-21	22-8-21	6-10-21	15-11-21	21-12-21	Gross Increase over 12 months	Weight of Fleece	Nett gain in body weight.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
ML_1L_1M ...	86	99⅓	95⅓	95⅓	94	103	111⅓	118	127	134	141⅔	142	56	12	44
ML_3L_3M ...	97	107	101⅔	97⅔	102⅓	109	116	122⅓	130⅔	138	146	146	49	13	36
ML_4L_4M ...	98	109	109⅓	105⅔	100⅓	106⅔	115⅓	124⅔	133	137	146⅔	142	44	13	31

Periodical Weights of Sheep in 1922.

Cross.	1-1-21	1-2-22	11-3-22	15-4-22	18-5-22	18-6-22	24-7-22	21-8-22	29-9-22	-11-22	1-12-22	31-12-22	Gross Increase over 12 months.	Weight of Fleece	Nett gain in body weight.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
ML_1L_1M ...	128	135⅔	137⅔	140⅔	141	136⅔	118⅔	126⅔	142⅓	142⅓	140⅔	141	13	10	3
ML_3L_3M ...	130	144⅔	144⅔	149	146⅔	142⅓	126	139⅓	148⅓	149	148⅔	150	20	11	9
ML_4L_4M ...	125	142	145⅔	143⅓	143	134⅓	122⅔	131⅓	142⅔	143⅔	146	147	22	10	12

PLOT II.—Cocksfoot 12 lb., Perennial Rye 15 lb., Cow Grass Clover 6 lb. per acre. Area, 4 acres.

Periodical Weights of Sheep in 1921.

Cross.	1-1-21	20-1-21	31-1-21	23-2-21	30-3-21	27-4-21	21-6-21	25-7-21	22-8-21	6-10-21	15-11-21	21-12-21	Gross Increase over 12 months.	Weight of Fleece	Nett gain in body weight.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
ML_1L_1M ...	83	93	93	92⅓	93⅓	99⅓	104⅓	108	116	119	131	139	56	12	44
ML_3L_3M ...	105	112⅔	113	112⅔	110	116	117	121	127⅓	133⅓	150⅔	161	56	11	45
ML_4L_4M ...	88	93⅓	94	93	95⅔	100⅓	104	107⅓	115	118	135⅓	138	50	11	39

Periodical Weights of Sheep in 1922.

Cross.	1-1-22	1-2-22	11-3-22	15-4-22	18-5-22	18-6-22	24-7-22	24-8-22	29-9-22	11-22	1-12-22	31-12-22	Gross Increase over 12 months	Weight of Fleece	Nett gain in body weight.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
ML_1L_1M ...	128	141⅓	144⅔	144⅔	142⅔	142⅓	117⅔	122	134⅔	130⅔	129⅓	130	2	9	−7
ML_3L_3M ...	150	165⅔	169⅓	171⅓	171	160⅔	140⅔	147⅓	157⅓	155	156⅔	157	7	11	−4
ML_4L_4M ...	133	147⅓	149⅔	151	151⅔	137⅔	118	128⅔	137⅓	135⅔	133⅓	132	−1	10	−11

– Signifies loss.

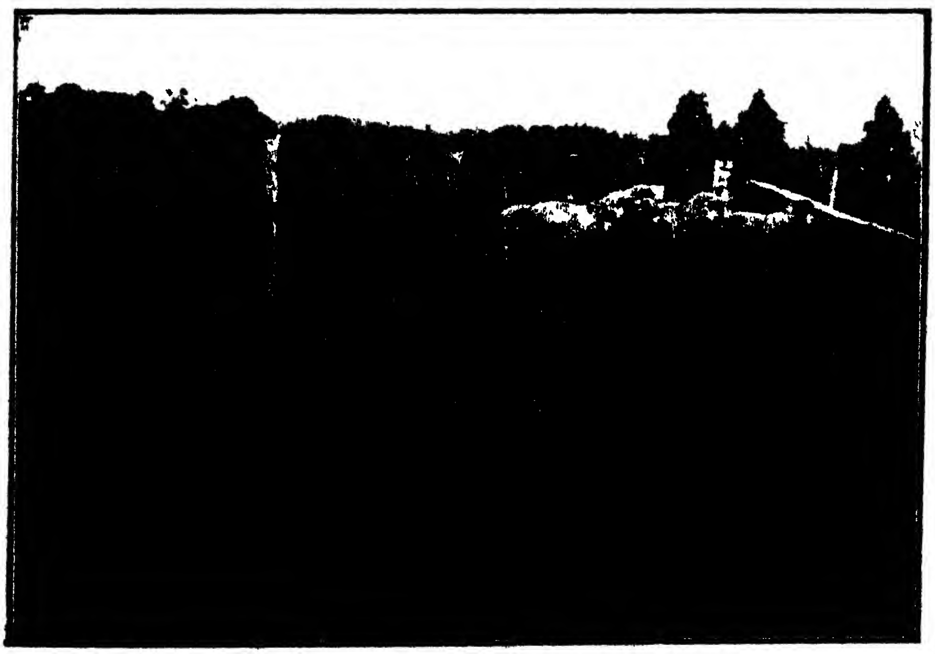
RAINFALL RECORDS.

	1921.	1922.		1921.	1922.
January	150	192	August ...	72	57
Febuary	171	81	September	404	321
March	456	202	October ...	605	126
April	187	33	November	295	163
May	626	3	December	926	433
June	602	242			
July ...	699	285	Total . .	51·93 in.	21 38 in.

The Behaviour of the Pastures in 1921.

PLOT 1, *Phalaris bulbosa* and White Clover.—When the sheep were first turned in on this plot there was excellent growth, and they kept in good condition until the end of February, when, because of dry weather, the grass was not very succulent. Good rain at the beginning of March brought on a fresh growth, and the grass shot up quickly while the clover made good succulent feed. The fresh growth scoured the sheep rather badly, and becoming very dirty, they were crutched during the first week in April.

In April the growth was very profuse and the sheep were unable to keep it down. During May the pasture did not show quite as well as the previous month, although plenty of feed was still available. Rain at the end of May and in June brought the pasture along again, however, the *Phalaris bulbosa* reaching a height of 6 to 8 inches. During June the sheep were in excellent condition.



Portion of the plot of Cocksfoot, Perennial Rye Grass, and Cow Grass Clover at Glen Innes Experiment Farm.

RESULTS for Year 1921 Compared.

Cross.	*Phalaris bulbosa* and White Clover.					Cocksfoot, Perennial Rye, and Cow Grass Clover.					Natural Pasture.				
	1-1-21	21-12-21	Gross Increase.	Weight of Fleece.	Nett gain.	1-1-21	21-12-21	Gross Increase	Weight of Fleece.	Nett gain.	1-1-21	21-12-21	Gross Increase.	Weight of Fleece.	Nett gain.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
ML_1L_1M	86	142	56	12	44	83	139	56	12	44	81	124	43	10	33
ML_2L_2M	97	146	49	13	36	105	161	56	11	45	83	127	44	10	34
ML_4L_4M	98	142	44	13	31	88	138	50	11	39	83	129	46	10	36

RESULTS for Year 1922 Compared.

Cross.	*Phalaris bulbosa* and White Clover					Cocksfoot, Perennial Rye, and Cow Grass Clover.					Natural Pasture.				
	1-1-22	31-12-22	Gross Increase	Weight of Fleece.	Nett gain.	1-1-22	31-12-22	Gross Increase	Weight of Fleece	Nett gain.	1-1-22	31-12-22	Gross Increase	Weight of Fleece	Nett gain.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
ML_1L_1M	128	141	13	10	3	128	130	2	9	—7	114	126	12	9	3
ML_2L_2M	130	150	20	11	9	150	157	7	11	—4	114	116	2	9	—7
ML_4L_4M	125	147	22	10	12	133	132	—1	10	—11	117	109	—8	9	—17

— Signifies loss

Summarising all the results obtained over the two years, the results show that the mixture of *Phalaris bulbosa* and White clover has been the most consistent pasture over the period, as shown in the following table:—

Phalaris bulbosa and White Clover.	lb.	Cocksfoot, Perennial Rye, and Cow Grass Clover.	lb.	Natural Pasture.	lb.
1921. Net gain of all sheep... ...	37	Net gain of all sheep	43	Net gain of all sheep	34⅓
1922. Net gain of all sheep	8	Net loss of all sheep	7⅓	Net loss of all sheep	7
Total net gain for 2 years	45	Total net gain for 2 years	35⅔	Total net gain for 2 years ...	27⅓
Average net gain for 2 years... ...	22·5	Average net gain for 2 years ...	17·8	Average not gain for 2 years...	13·6

The artificial pastures were stocked, as stated above, at 2½ sheep per acre, and the natural pastures at one sheep per acre.

From June to December wet conditions were experienced, and the plot provided abundant feed. The condition of the pasture practically remained the same all through this period.

Throughout the year excellent conditions as regards rainfall prevailed, the plot providing more feed than was required by the sheep.

PLOT 2, Cocksfoot, Perennial Rye, and Cow Grass Clover.—This plot did not at any stage contain the same bulk of fodder as the first one. At the end of February the paddock was very dry and bare in places; where protected, the Cow Grass clover was green, but in small quantities. The weights of the sheep did not vary so much as in the former paddock. After the March rains the plot recovered quickly, the clover making good headway. With one exception the sheep did not scour, but they were crutched at the same time as those on Plot 1. In April the cocksfoot and rye grass made good growth, but not so good as the *Phalaris bulbosa* in the other paddock. The sheep were able to cope with the growth and kept in good condition. This paddock was also affected by the dry weather in May, but enough feed was available for the sheep to keep up their condition.

From June to December this plot behaved similarly to the first plot, but as the hot weather came along the quantity became scarcer, though the quality was excellent for sheep feed.

The Year 1922.

For the twelve months ending 31st December the rainfall totalled 21·38 inches, or 10·62 inches lower than the district's average of 32 inches.

At the beginning of the year the pastures were in splendid condition owing to the bounteous December rains. From January to May conditions were very dry, the pastures becoming very dry and sparse: only 3 points of rain fell in May. During June 242 points of rain were registered, and a short growth appeared, especially on the *Phalaris bulbosa* and rye grass. A dry August caused a lack of the usual spring growth. September gave improved conditions, and the grasses and clovers made good headway, only to be checked during October by further dry conditions. November was also very dry, but December gave a rainfall of 433 points which eased the situation somewhat.

From January to March Plot 1 was very noticeable on account of its abundant growth, due to the heavy December rainfall. The foliage of *Phalaris bulbosa* reached a height of 5 to 6 inches and seed stems 2 feet; the grass seeded profusely. This paddock dried off more quickly than the cocksfoot and rye, but a great point in its favour was that all through the dry period of the winter the tall, dry seed stems of *Phalaris bulbosa*, which had fallen and covered the ground, protected and mulched the young shoots which were thus able to provide a certain amount of succulent feed that was not to be found on the other plot. Throughout the twelve months this paddock had a better growth of feed on it than Plot 2.

For the first three months Plot 2 had ideal sheep feed growing on it—short, succulent, and green. When the weather became dry during the winter, however, the paddock suffered very much and little else could be seen but the bare crowns of the grass, though the sheep increased in weight. Towards the end of the year better growth was in evidence, but over the twelve months this pasture had nothing like the quantity of fodder on it that Plot 1 had.

Similar groups of sheep were also grazed on natural pasture for purpose of comparison with the cultivated pastures already referred to. The sheep on natural pasture were only at the rate of one sheep per acre. In addition to the pasture they were turned on to stubbles of fodder crops, clover experiments, &c.

The accompanying tables show the monthly weighings of each class of crossbred on each of the two plots, and also for similar crossbred sheep on natural pasture. The figures in each case show the average of the three animals of the particular cross mentioned.

I desire to acknowledge the valuable assistance rendered in these trials by Messrs. V. H. Bruce and W. Webster, stock assistants.

The Importance of Fodder Conservation.

While there has been considerable improvement in farming practices in recent years, especially in regard to improved cultural methods, rational use of fertilisers, and the selection of varieties suitable to the particular circumstances of the farmer, there has not been a similar advance in regard to the care of stock. Although cows are worth a great deal to the dairy-farmer and sheep to the grazier, there has not yet been any systematic effort to provide feed to save them during drought periods, by the making of silage. Farmers' returns are affected by many circumstances, but there is none so widespread in causing loss of production or loss of stock as drought, and possibly there is none which is so easy of correction. Diseases of plants cause loss, but the total is infinitesimal compared with the loss caused by periodical shortage of feed, and while control measures for plant diseases can only be devised by long and patient investigation the remedy for drought with most stockowners is right at hand. In view of the importance of fodder conservation the field officers of the Department devote considerable time to instructing farmers in the conservation of silage, and in bringing to their notice the advantages of fodder reserves, and it is satisfactory to note that success seems to be rewarding their efforts.—A. H. E. McDonald, Chief Inspector of Agriculture.

Where Sunflowers are More Valuable than Maize.

Sunflowers are preferable to maize in regions where, on account of cool weather, the latter crop will not grow successfully. Maize requires hot weather both during the night as well as the day, to make satisfactory growth, while sunflowers, on the other hand will grow well in a much cooler temperature. This is by all means the most distinguishing characteristic between the two crops.—E. S. Hopkins, Dominion Field Husbandman, in *Seasonable Hints*, Canadian Department of Agriculture.

Forage Poisoning.

H. G. BELSCHNER, B-V.Sc., Inspector of Stock, Nyngan.*

An interesting case of mortality in horses, due, in my opinion, to forage poisoning, caused by the horses eating damaged wheaten silage, came under investigation at Warren recently. The history of the outbreak is as follows:—

The owner first noticed one of his horses sick on a Saturday morning and exhibiting sluggishness, stiff gait, salivation and slight discharge from nostrils, protruding tongue, and inability to swallow food or water. The animal did not appear to be in any pain, but was very dull: died Sunday morning.

The second horse first showed signs of the trouble on Sunday morning, and, as in the first case, exhibited the lolling tongue and inability to swallow. The animal died on Sunday night without struggling.

Both these horses, together with six others, had been fed almost exclusively during the previous six weeks on wheaten pit silage. I arrived in time to observe the symptoms in the third horse. The animal was very depressed, standing with head slightly extended, mucoid discharge from nostrils, tongue hanging out of mouth, somewhat congested at tip, some salivation. There was an inco-ordination of the movement of the limbs and the animal walked with a proppy gait. The abdomen was a little tucked up, breathing slightly accelerated, and there was a slight temperature (102 degrees Fah.); fæces dark coloured (from silage), but coated with mucous, smell not offensive; animal unable to eat or drink, apparent paralysis of throat and tongue; died Monday evening.

A post-mortem examination of the second horse on Monday afternoon revealed some congestion of the mucous membrane of the stomach The small intestine and single colon contained a large quantity of dark-coloured fluid, and the single colon exhibited several areas of congested mucous membrane. The mesentery was injected. The lungs were slightly congested, but all the other organs appeared normal. An autopsy on the third horse disclosed practically the same changes as in the second case, with the exception perhaps of somewhat great inflammation of the bowels.

The silage on examination smelt good, and on the surface looked all right. A few sheaves pulled out from the unopened portion of the pit appeared all that could be desired for good silage. The other half of the pit was opened and a fair quantity removed; 30 points of rain had fallen on this the week before, and on turning over a few sheaves I found them to be

* Paper read before the Stock Inspectors' Conference, 1923

very mouldy, particularly sheaves from the sides of the pit. The owner informed me that a good deal of silage he had been feeding to the horses recently was mouldy, but the horses always ate it.

Although the horses were removed from the silage as soon as it was suspected, they all became affected during the course of the following few days. The symptoms, however, in the later cases, developed more gradually, and the horses took longer to die. Of the eight horses, seven died and one recovered slowly. Two other horses on the place that had been fed on chaff and received no silage did not get sick. The first three horses that died were light horses, the others draughts: the sexes were mixed, and the ages varied.

Very little treatment was attempted, as it was not considered advisable to drench the horses once paralysis of the throat had set in. As a precautionary measure, six of the horses were given a pint of raw linseed oil each. Small feeds of chaff and bran were given, and as the horses became affected an attempt was made to nurse them, which was of no avail.

Similar mortalities among stock, more particularly horses, have been recorded in other parts of the world, and in Australia. A certain amount of investigation work has been carried out, especially in U.S.A. The results of many experiments tend to show that the disease is produced by some poison or toxin taken in with the food, and the toxin suspected is that produced by the *Bacillius botulinus*. The condition "botulism" is a food poisoning produced by the presence in and absorption from the alimentary tract of a toxin produced by the *Bacillus botulinus*, a large anaerobic, spore-forming bacillus. The toxin of *Bacillus botulinus* is the only true toxin so far known which is absorbed through the intestinal walls, and so affecting the central nervous system. It is in this respect that it differs from the toxin produced by the tetanus and diphtheria bacillus. It appears also that *B. botulinus* is able to grow and produce its toxin in many foodstuffs, both vegetable and animal, and that it can exist not only under anaerobic conditions, but also under apparently aerobic conditions.

This would account for its growth in an open silo, and for the fact that it seems to grow in silage, mostly in association with moulds and other micro-organisms found in the silage. Such association is not always necessary.

The symptoms vary a good deal in different outbreaks, and as a result various names have been given the disease—toxæmia paralysis, sleepy staggers, cerebritis, &c. Often the first symptom observed is the unsteady gait, and the animal may go down and make no attempt to rise. Again, the first symptom may be paralysis of the throat and tongue, and inability to swallow (this being a characteristic symptom). There is seldom any rise in temperature. The mortality is always high, up to 100 per cent., and those that recover are generally the ones affected late in the outbreak. The Warren outbreak is typical of the course of the disease.

Investigators have shown that there are two distinct strains of the *B. botulinus*, and an anti-toxin may be prepared against each toxin. Hence, it is evident that if an anti-toxin is to be used against the disease, or as a

preventive, a mixture of the two types of anti-toxin must be used unless the strain of bacillus is known. Cattle and sheep are not so susceptible to the disease as horses and mules. The prevention of the disease lies in preventing the orginal contamination. It is impossible, however, to preserve our stock foods as we do food used for human consumption.

Burke, of California, has done a great deal of work in attempting to locate in what type of material the bacillus is found, and concludes that the organism is widely distributed in nature, and that it seems to occur in the vicinity of the habitations of man.

Wyant, of East Lansing, Michigan, writes as follows:—"So far as is known no medicine is of any value in the treatment of this disease. As the symptoms are a result of the action of the toxin on certain portions of the nervous system, it is very evident that some time must have elapsed before symptoms appeared, and no medicine could then be of avail if administered by way of the mouth or even if hypodermically injected.

"Mouldy Silage Suspicious.—In the case of livestock the one who has charge of feeding them with silage especially should look with suspicion upon mouldy portions. Neither moulds nor their products have been proved to be poisonous, but because of the possibility of the presence and growth of *B. botulinus* under such condition, spoiled silage should be fed with great caution.

"In some cases only a small quantity of food appears to be harmful, and this may all have been consumed before the symptoms become manifest."

Dr. Seddon, of the Glenfield Veterinary Research Station, who examined some of the silage taken from the pit from which the affected Warren horses had been fed, reported as follows:—

"Though we were unable to confirm bacteriologically the diagnosis of forage poisoning, I do not think from the incidence and symptoms as described by Stock Inspector Belschner that there is any doubt that the cases were in fact those of forage poisoning.

"Whilst the examination here has been negative, such a result is not unusual, for these toxins act only after an incubation period, which means that it is the feed eaten, say, two to five days before the symptoms have developed, which has provided the intoxication. For that reason, unless a large amount of the feed is toxic, there is little or no chance of securing a sample likely to give positive results.

"These cases seem, therefore, to support the idea that the toxin is developed frequently only in certain portions of a stack."

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The Duroc-Jersey Pig.

E. A. SOUTHEE, Principal, Hawkesbury Agricultural College.

THE popularity of the Duroc-Jersey in the United States of America, where some 40 per cent. of the total swine belong to this breed, has prompted some enthusiastic pig-breeders to import Duroc-Jerseys into this country with a view of determining their suitability for our conditions and requirements. The following notes, culled chiefly from American sources, may prove useful to those interested.

The breed is noted for hardiness and for making good "grazers." Prolificacy and docility mark the sows, which are good milkers and good mothers.

The Duroc-Jersey, with its moderately long, straight head, drooping ears, and smooth neat body, bears a rather close resemblance to the big-type Poland-China in form, being somewhat stronger in limb.

The colour is "cherry red, without admixture," though variations such as "bright red" and "dark cherry" are allowable. The legs are of medium length and the feet and bones of good quality.

The boars are massive, have good length and depth, with good backs; the sows are upstanding, having good depth with good backs.

The Duroc-Jersey is classed as a large pig, of the "lard" type.

The following scale of points, adopted by the American Duroc-Jersey Record Association, summarises the outstanding features of the breed :—

	Points.
Head and Face.—Head small in proportion to size of body, and wide between eyes; face nicely dished (about halfway between a Poland-China and a Berkshire), and tapering well down to the nose; surface smooth and even	4
Eyes.—Lively, bright and prominent	2
Ears.—Medium, moderately thin, pointing forward, downward, and slightly outward, carrying a slight curve; attached to head very neatly	2
Neck.—Short, thick and very deep; slightly arching	2
Jowl.—Broad, full and neat, carrying fulness back to point of shoulders, and on a line with breastbone	2
Shoulders.—Moderately broad, very deep and full, carrying thickness well down and not extending above line of back	6
Chest.—Large, very deep, filled full behind shoulders; breastbone extending well forward so as to be readily seen	12
Back and Loin.—Back medium in breadth, straight or slightly arching, carrying even width from shoulder to ham; surface even and smooth	15
Sides and Ribs.—Sides very deep, medium in length, level between shoulders and hams and carrying out full down to line of belly. Ribs long, strong and sprung in proportion to width of shoulders and hams	8
Belly and Flank.—Straight and full and carrying well out to line of sides. Flank well down to lower line of sides	6
Hams and Rump.—Broad, full and well let down to the hock; buttock full and coming nearly down and filling full between hocks. Rump should have a round slope from loin to root of tail, same width as back, and well filled out around tail	10

Legs and Feet.—Medium size and length, straight, nicely tapered, wide apart and well set under the body; pasterns short and strong. Feet short, firm and tough	10
Tail.—Medium, large at base and nicely tapering and rather bushy at end	1
Coat.—Moderately thick and fine; straight, smooth, and covering the body well ...	2
Colour.—Cherry red, without other admixtures	2
Size.—Large for age and condition. Boars 2 years old and over weigh 600 lb.; sows, same age and condition, 500 lb.; boars, 18 months, 475 lb., sows, 400 lb.; boars, 12 months, 350 lb., sows, 300 lb.; boar and sow pigs, 6 months, 150 lb. These figures are for animals in a fair show condition	5
Action and Style.—Action, vigorous and animated. Style, free and easy	4
Condition.—Healthy; skin free from any scurf, scales, sores, and mange; flesh evenly laid over the entire body and free from any lumps...	4
Disposition.—Very quiet and gentle; easily handled or driven	3
Total	100

Regulations Regarding Dried Fruit.

As a result of conferences between Commonwealth officers and representatives of the Fruit Branches of the New South Wales and South Australian Governments, regulations have been adopted regarding the grading and packing of dried fruits for export, and an indication of their scope will be of interest to growers.

The regulations provide that the fruit shall be prepared from sound, naturally ripened fruit, and possess the flavour characteristic of its kind. It shall be thoroughly cured and free from fermentation, mould, decay and undue stickiness, and from grit, insects, or other matter foreign to the fruit. The outer layers or shown surfaces of the fruit shall be a true indication of the average grade of the contents of the case. The grading of the fruit shall be in accordance with the regulations, and the name of the fruit shall be set out in the trade description in legible characters, and if any pictorial representation of fruit is included in the trade description it shall be a true representation of the kind of dried fruit contained in the package to which the pictorial representation is applied.

Whether or not the fruit is enclosed in immediate containers, such as closed tins, jars or cartons, it shall be packed in clean, new cases of well-seasoned hardwood or softwood that has been smoothly sawn and strapped with metal strapipng or wire. The fruit shall be packed in cases of 56 lb., 28 lb., 14 lb., and 7 lb. capacity, according to the kind, and the ends, sides, bottoms and lids of such cases shall be made to a specified thickness.

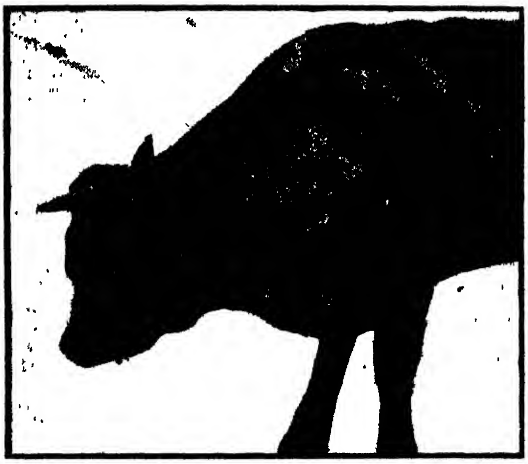
Copies of the regulations may be obtained on application to the Federal Government Printer, Melbourne, price 6d.

A New List of the Department's Publications.

Many farmers are unaware of the authoritative agricultural literature to which they may have access at the Department of Agriculture, at the cost, in many cases, of only the postage. A revised list of the bulletins and pamphlets published by the Department is now available. All of these publications have been written by practical men specifically for the local farmer. The list is obtainable free on application to the Under Secretary and Director, Department of Agriculture, Bridge-street, Sydney.

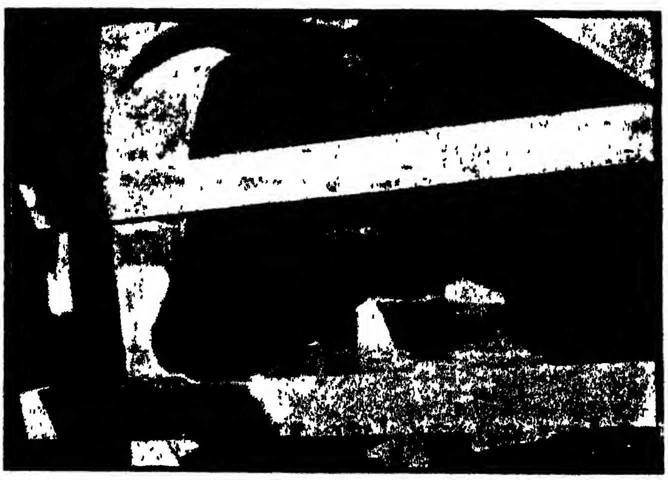
"Lumps" in the Throats of Cattle.

It sometimes happens that cattle develop "lumps" in the throat, caused by some sharp, hard seeds or prickly roley-poley which they have eaten penetrating the soft tissues and becoming fixed. The presence of this foreign body causes the formation of pus, or as is commonly said, "it starts to fester," as would be the case of a splinter that had not been removed from the hand. The pus thus formed burrows downwards through the soft tissues and becomes arrested for some time by the thick skin, but eventually, aided perhaps by the animal rubbing the part, penetrates the skin and is drained away.



Lump on Throat caused by presence of foreign matter. Note the lump under the throat.

After the original cause of the trouble has been removed, the discharge ceases and parts heal, often leaving a scar and a thickening of the area immediately surrounding it. These swellings often appear near the site of the submaxillary lymphatic glands, and may be mistaken for enlarged tuberculous glands. This error has at times led to needless destruction of animals.



A case in which the Lump is still discharging.

The accompanying snapshots of cattle, which, owing to drought conditions had subsisted partly on prickly roley-poley, show instances of the swellings referred to above.—E. Reuss, Inspector of Stock, Coonamble.

Diseases of the Cotton Plant.

W. A. BIRMINGHAM, Assistant Biologist, and I. G. HAMILTON,
Australian Cotton Growing Association, Limited.

OWING to the gradually increasing importance of the cotton crop in New South Wales, and the likelihood of its playing a greater part in our agriculture in the near future, a brief review of the pathological diseases to which it is liable seems opportune.

At present our knowledge of the diseases of cotton in Australia is strictly limited; but by presenting a short account of those which affect this plant in other countries (some of which we know also to be present in our State) it is hoped to stimulate the interest of all having to deal with the crop and to secure their aid in as quickly as possible building up local knowledge.

During the coming season it is hoped to secure information which will enable us to determine the exact nature and distribution of what are going to prove our most formidable diseases. In carrying this into effect it is hoped to secure the co-operation of growers, who are requested to forward samples of any diseased condition that may appear. Whole plants packed in cardboard boxes should be sent, if possible, consigned to the Biological Branch, Department of Agriculture, Mining Museum, George-street North, Sydney. Together with the sample, as much information as possible throwing light on the following points should also be forwarded :—

1. The severity of the attack.
2. Other occurrences of a similar nature in the neighbourhood.
3. The parts of the plant showing the diseased condition; a sample of each part should be forwarded to the Biological Branch if it is impossible to send the whole plant.
4. A description of the exact location of the field or part of field containing the affected plants.
5. When the disease was first observed and the kind of weather which immediately preceded its appearance.
6. The nature of the soil and subsoil, especially with regard to moisture.
7. The cultivation and manuring of the field.

In the meantime, the grower is reminded that correct cultural methods play a large part in maintaining the health of a crop, and hence in lessening its liability to attack.

The following is a list of the fungous and other diseases which affect the cotton plant :—

(*a*) PHYSIOLOGICAL DISEASES.—(1) Boll-shedding, (2) "Rust" (so-called), (3) Club Leaf or Cyrtosis, (4) Blue Cotton.

(*b*) BACTERIAL DISEASES.—(1) Angular Leaf Spot (***Bacterium malvacearum***), (2) Crown Gall (***Pseudomonas tumefaciens***).

(*c*) FUNGOID DISEASES.—(1) Anthracnose (***Colletotrichum gossypii*** **South**), (2) Wilt (***Fusarium vasinfectum***), (3) Texas Root Rot (*Ozonium omnivorum* Shear), (4) Sore Shin (*Corticium vagum* B. & C. var. ni Burt), (5) Internal Boll Disease, A.B.C. & D. Nowell, (6) Southern Blight (*Sclerotium rolfsii* Sacc.), (7) Leaf Spot or Blight (*Cercospora gossypina* Cke.), (8) False or Areolate Mildew (*Ramularia areoli* Atk.), (9) Rust (*Uredo gossypii* Atk.), (10) Mildew (*Oidium* sp.), (11) Diplodia Boll Rot, (12) Fusarium Boll Rot, (13) Leaf Blight (*Alternaria* sp.), (14) *Hymenochætæ noria* Berk, (15) *Phyllosticta malkoffi* Bub., (16) *Phoma roumii*. Trau.

(*d*) Eelworm (*Heterodera radicicola*)

Boll-shedding.

This represents a serious loss of crop in every cotton-growing country; in fact, with regard to the United States, Gilbert says, "in the aggregate the loss from shedding is greater than that from all the cotton diseases combined. Loss of 40 to 60 per cent. of bolls is a fairly common occurrence." Harland, with regard to the West Indies says: "The chief loss of crop is due to the shedding of bolls and buds." In Egypt, Balls says, boll-shedding is a "matter of great economic importance," the actual loss being about 40 per cent. The bolls shed vary in age considerably, from one or two days old to nearly mature bolls. In Egypt, the bulk of the loss from this cause is due to the falling of the very immature organs three or four days after the opening of the flowers. Balls says, "ripening bolls, up to 2 centimetres in diameter, may be shed, but this is less common." In the United States and West Indies the shedding is chiefly of more mature organs, beginning about a week after the flowering period and gradually increasing as the season advances. Harland says: "According to Balls, boll diseases are almost unknown in Egypt, whereas in St. Vincent they are the chief agents responsible for the heavy shedding of bolls."

Nowell gives a very good general statement of the causes leading to boll-shedding: "It has been established that shedding occurs when from any cause whatever the amount of water taken in by the roots falls short of that which is given out by the leaves. Undue exposure to wind, caking of surface soil, drought, root interference, root pruning by cultivation, excessive vegetative growth brought on by rain during the flowering period, and the asphyxiation of the roots in water-logged soil are all capable of bringing about boll-shedding."

Rust (so-called), Yellow Leaf Blight and Potash Hunger.

This is a purely physiological condition, characterised by the production of reddish-coloured leaves, which drop off prematurely. In severe cases the

plants may be stripped of their leaves, leaving only the bare stalks. The cotton produced by rusted plants is very weak and inferior. Harland, in carrying out manurial experiments with Sea Island cotton in the West Indies, found that it was only those plots which were not treated with potash manure which showed this affection. The obvious remedy, therefore, is to supply potassium to land which grows "rusted" cotton plants.

Fig. 1.—Branch of a Chinese Cotton Plant affected by Club Leaf (Cyrtosis).

In the lower part the internodes are of normal length and leaves of normal size and shape, but change aruptly in the upper part to the short internodes and distorted leaves that characterise the disorder—[*After Cook.*]

Club Leaf or Cyrtosis.

This is a peculiar disease of cotton plants in China, which was investigated by O. F. Cook in 1920. No causal organism has so far been discovered, so that the disease is for the present classified as a physiological one.

Recognition.—The plants in an affected area are modified in every possible part of their structure—the leaves are reduced in size, discoloured, and distorted, the petioles and internodes are shortened and the branching habit changed (see Fig. 1).

Cause.—The condition may be of the nature of a mosaic disease or of a leaf curl, the infective agent being transmitted by plant lice. The disease is not seed-borne.

Control.—Club leaf is most injurious during hot weather at the height of the fruiting season, so that early planting to ripen the crop quickly is likely to be efficacious. There is also a possibility of breeding out resistant varieties.

Blue Cotton.

Blue cotton is a peculiar condition of cotton which occurs to a limited extent on the Sea Islands and in Florida. It is characterised by the deep green or bluish colour of the leaves, the prostrate habit of the plant and the shedding of the fruit. The use of organic manures appears to aggravate the trouble. On the Sea Islands the use of salt, mud, and lime, and also drainage have been found to have a remedial effect.

Angular Leaf Spot (*Bacterium malvacearum* E. F. Sm.).

Variously known as bacterial blight, bacterial boll-rot, black-arm, or angular leaf spot, this disease is of more or less importance, according to climatic conditions. It is very widely distributed, being known to occur in the United States, the Philippines, Nyassaland, Egypt, China, Barbados, Turkestan, and Pretoria.

Damp, low-lying situations appear to favour the disease. The amount of damage which it does varies from nil to as much as 75 per cent. or more in severe cases.

Recognition.—Its greatest damage is done to the bolls. The first signs are small, dark-green, water-soaked, roundish spots on the bolls, which gradually enlarge and turn black in the centre as the tissues are killed and shrink (Fig. 2). Frequently two or three locules of the entire boll are so injured that they fail to open, or if they do the fibre is found to be discoloured and rotten. Often the boll pedicel is attacked and killed, so that the boll dries up and either falls off before maturity or fails to open.

The most general and conspicuous evidence of the disease is given by the angular spots on the leaves. The spots never cross the larger veins, hence their angular form (Fig. 3).

The stems may also be attacked when the external skin is killed and the branches turn black, hence the name " black-arm." It also causes a wilting off of the seedlings similar to that caused by " sore shin." The wilting produced by angular leaf spot may be distinguished by being more sudden and by the water-soaked appearance of the attacked portion.

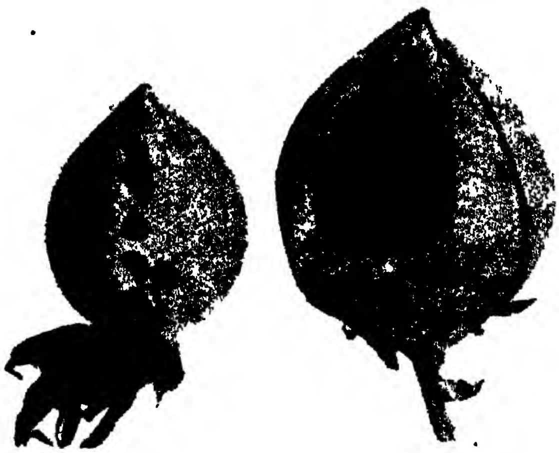


Fig. 2.—Bacterial Boll-rot of Cotton (*Bacterium malvacearum*).
[*After Gilbert.*]

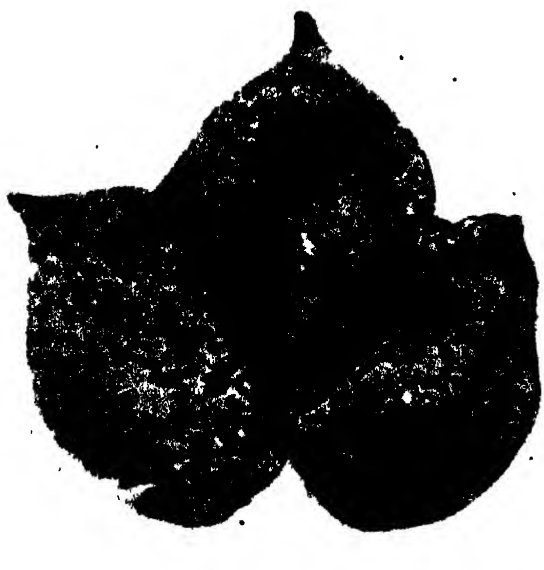


Fig. 3.—Angular Leaf Spot of Cotton (*Bacterium malvacearum*).
[*After En. Smith.*]

Cause.—The disease is caused by a rod-shaped bacterium, ***Bacterium malvacearum.*** The organism gains entrance into the plant through the stomata or through injuries. It may live on the seed and lint for at least our months, and also in the soil for a considerable period.

Control.—1. Sterilisation of the seed. This treatment is usually only used for special seed, being too expensive for general use. The lint is first removed with concentrated sulphuric acid and then the seed is treated with hot water at 72 deg. Cent. (161 deg. Fah) for eighteen minutes or with mercuric bichloride (1 part in 1,000 parts of water) for one hour. Earthenware vessels or wooden vessels coated with melted roofing pitch should be used for treatment with sulphuric acid. 2. Seed from disease-free fields only should be used

Crown Gall (*Pseudomonas tumefaciens* S. & T. Stev.).

Crown gall is of very little economic importance as regards the cotton plant. It forms natural galls on this as well as on numerous other plants. The outgrowths are formed at about the level of the ground and on the main roots.

(*To be continued.*)

INHERITANCE OF MILK-YIELDING CAPACITY.

DISCUSSING the inheritance of milk-yielding capacity and the part played by the sire, a recent issue of the ***Journal of the Ministry of Agriculture*** (England) draws attention to interesting investigations carried out at the Maine Agricultural Experiment Station in this connection. When an analysis was made of the "Advance Register of Dairy Bulls" maintained by the Jersey Breed Association, it was found that out of 200 bulls the records of whose daughters were available, approximately one half sired daughters whose records surpassed those of their dams. The results of a similar investigation in relation to the Holstein-Friesian breed, published since, show similar results. An examination of the Advance Register of this breed showed that there were 111 Holstein-Friesian sires having two or more daughters with recorded yields. Of these, 65—or roughly one-half—raised the milk yield of their daughters over that of the dams of these daughters. The list was headed by a bull that, on an average, raised the milk yield of his daughters by 7,610 lb.; another raised the milk yield of fourteen daughters, on the average, by 4,860 lb.

"These figures," comments the *Journal,* "are independent of any theory: they show clearly how important an influence the sire exercises on the performance of his daughters. They demonstrate, moreover, that pedigree by itself is not a guarantee of performance: pedigree makes performance more likely, and it appears to be an even chance whether a pedigree sire will raise the level of the herd or not. Although the probability that he will maintain it at the same level is greater, still the fact remains that he sometimes lowers it, and that the best test of the milking quality of a sire is provided by the records of his progeny. It is, therefore, to be deplored that, for reasons which appear to be peculiar to this country, the prevalent practice is to slaughter the dairy bull before the records of his daughters are available."

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Corn Cockle (*Agrostemma Githago* L.).

Caryophyllaceæ: Pink Family.

Botanical Name.—*Agrostemma*, from *agros*, a field, and *stemma*, a crown; alluding to the beauty of the flowers, which were formerly made into crowns or garlands. *Githago*, from *gith* or *git*, a black seed, which was used by the Romans in cookery; *ago* in botany, when it terminates a word, usually signifies resemblance with the word that precedes it as *gith* and *ago*, resembling *gith*.

Common Names.—In Europe and America the following vernaculars are applied to it:—Corn Cockle, Purple Cockle, Corn Lychnis, Corn Rose, Corn Campion, Crown of the Field, Mullein Pink, Old Maid's Pink.

Popular Description.—A slender, sparsely branched annual, 1 to 3 feet high, covered with rather long whitish hairs. Leaves narrow and pointed, 2 to 5 inches in length. Flowers reddish-purple, ½ to 1 inch in diameter, or even more on well-grown plants, borne on the end of long, leafless stalks; the long, narrow, green calyx lobes project well beyond the showy petals. Seed vessel oval, ½ to 1 inch long, containing twenty to forty dark-brown or black seeds, which are about the same size and weight as a grain of wheat, somewhat triangular in outline, with rounded corners, and decidedly rough with fine rows of minute teeth. It is estimated that an average plant produces about 500 seeds; the seeds are known to retain their vitality in the soil for a number of years.

Botanical Description.—A slender, erect annual, simple or sparsely branched, clothed with appressed whitish hairs; leaves linear, acute, to narrow acuminate, 2 to 5 inches long; flowers solitary or rarely in pairs, on long slender leafless peduncles, ½ to over 1 inch broad, red or reddish-purple, inodorous; petals rather broad, undivided, the lamina without scales; calyx lobes green, linear, projecting much beyond the petals; capsule ovoid, one-celled ½ to 1 inch long, separating at the apex into fine teeth; seeds brown or black, somewhat triangular with rounded corners striated, tuberculate $\frac{1}{12}$ to ⅛ inch in diameter.

Where Found.—Corn Cockle is a common weed in fields, pastures, roadsides, and waste places throughout Europe and Russian Asia. In America it is widely diffused throughout the wheat-producing states, and a constant warfare is waged against it. It has made its appearance in Queensland, Victoria, and also in this State. Specimens were received at the National Herbarium for identification in 1917, from Mr. J. D. Berney, Eurimbla, *via* Cumnock, who stated that they were growing in a wheat crop. There are,

Corn Cockle (*Agrostemma Githago* L.).

however, much earlier records, but without definite locality. It is quite possible that it is also in other wheat-growing districts in the State, and farmers should keep a sharp watch for this weed, and destroy it before it sets its seeds. If there is any doubt about its identity, specimens should be wrapped in paper and forwarded to the Director, Botanic Gardens, for identification.

A Bad Agricultural Weed.—Corn Cockle has been known in Europe and parts of Asia for centuries on account of its poisonous seeds, and owing to their size they are difficult to screen from wheat, with which it is commonly found. Cockle-infested grain has been known to poison various kinds of domestic animals; and bread made from the flour has caused fatal results

The following extracts concerning its poisonous properties are taken from "Principal Poisonous Plants of the United States," by V. K. Chestnut.

Poisonous Constituent.—The poisonous constituent, saponin, is a non-crystalline powder, very freely soluble in water, and possessing a sharp, burning taste. It has no odour, but when inhaled in the smallest quantity it produces violent sneezing. When briskly shaken in water it froths like soap. The poison is found in nearly all parts of the plant, but mainly in the kernel of the seed.

Causes of Poisoning.—Cases of poisoning have been noted among all sorts of poultry and household animals, but are rarely due to any portion of the plant as found growing in the field. The poisoning is generally produced by a poor grade of flour made from wheat containing Cockle seeds. Machinery is used to remove these seeds from the wheat, but the difficulty of separating them is so great that it is not entirely accomplished. The quantity remaining determines the grade of the flour in this particular regard. It sometimes amounts to 30 or 40 per cent., but this quality is sent out only by ignorant or unscrupulous dealers or is intended for consumption by animals only. Flour containing a smaller amount has often been made into bread and eaten sometimes with fatal results, the baking not always being sufficient to decompose the poison. The effect may be acute, or, if a smaller quantity of the meal is eaten regularly, it may be chronic. In the latter case, it is sometimes known as a disease under the name of "githagism."

Symptoms.—The general symptoms of acute poisoning are as follows:—Intense irritation of the whole digestive tract, vomiting, headache, nausea, vertigo, diarrhœa, hot skin, sharp pains in the spine, difficult locomotion, and depressed breathing. Coma is sometimes present, and may be followed by death. Chronic poisoning has not been closely studied in man, but experiments upon animals show chronic diarrhœa and gradual depression, the animal loosing vigour in breathing and in muscular movements until death ensues. The action is antagonised by the use of digitalin, or of the simple extract of digitalis (*Digitalis purpurea*), the common foxglove, a dangerous poison which should be given only by a physician.

Corn Cockle meal is easily detected in second and third class flour by the presence of the black, roughened scales of the seed coat. These are sure to occur if the flower has not been well bolted. Its presence is otherwise detected by the peculiar odour produced when the meal is moistened and by chemical tests with iodine.

Means of Control.—It is to the farmer's interest that he should know this undesirable plant, and the illustration gives a very good idea of what it is like. It is readily detected in the growing crop, by its whitish, hairy leaves and slender stem, or by its conspicuous reddish-purple, odourless flowers, which appear among the ripening grain.

Since Corn Cockle is not very well established in the State there should be no difficulty in keeping it under control, and wheat containing Cockle seed should not be sown. Isolated plants should be hand-pulled before the seed is ripe. If, however, plants have run to seed before they are detected they should be carefully cut, and carried from the crop and burnt.

Thickly infested patches may be successfully treated by an application of copper or iron sulphate. Spraying with a 2 per cent. solution of copper sulphate gives good results, as does a 20 per cent. solution of iron sulphate. On the whole, the same treatment may be adopted for Corn Cockle as that outlined for Mustard in the October issue of the *Gazette*.

Summer School in Bee-keeping at Hawkesbury Agricultural College

The Minister for Agriculture (the Hon. F. A. Chaffey) has approved of arrangements beings made for a Summer School in bee-keeping to be held at Hawkesbury Agricultural College from 2nd to 18th January next, to be limited to twenty students, who will be charged a fee of £4 4s. to cover board and lodging, etc., during the course. Applicants of either sex, over 16 years of age, will be eligible for admission and the necessary application should be directed to the Under Secretary, Department of Agriculture, Sydney. Reduced railway fare is available at two-thirds ordinary rates for the return journey from Richmond only. The North Coast Steam Navigation Company, Limited, has also agreed to allow a 10 per cent. reduction on the steamer fares of any students attending the school.

In drawing up the programme for the school, particular care has been taken to provide the widest possible practical and theoretical training for the limited time available, and every phase of apiary work is given adequate attention.

Coming as it does in the height of the honey season, this School provides an excellent opportunity for students who desire to secure a sound knowledge of bee-keeping under the most favourable conditions.

An Uncommon Condition of Mandarin Fruit.

W. A. BIRMINGHAM, Assistant Biologist.

On 10th June, 1923, Inspector Hunter submitted some specimens of Emperor mandarins from Glenorie, showing a condition not previously met with. Instead of being covered with a skin of uniform thickness and colour, each fruit was covered with a skin of a green colour and of uniform thickness at the summit and the base of the fruit, while between those areas were depressions of a bright yellow colour, the depressions being in many cases to a certain extent correlated with the natural internal segments of the fruit (see Fig. 1). On the surface of these depressed areas, small, pimple-like outgrowths occurred (see Fig. 2).

Microscopical examination showed these protuberances to be expansions of the outer layers of the skin. The pimples or outgrowths in section showed them to be filled with a tissue of comparatively thin-walled cells. In the small pimples the interior was completely filled with this tissue; in the larger pimples the interior was in many cases hollow.

Mr. Hunter, Orchard Inspector, stated that "the trees were in fair condition and were manured."

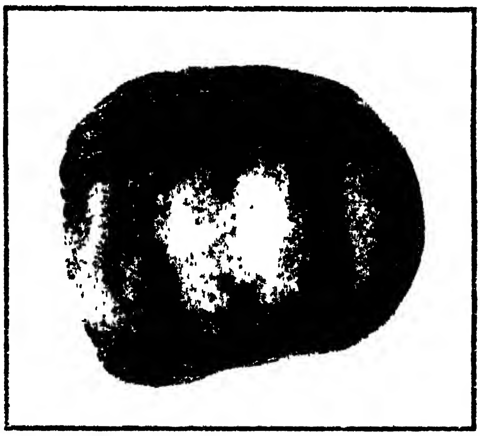


Fig. 1.—Emperor mandarin, showing depressed areas with minute black dots forming the pimple-like outgrowths.

An investigation was carried out in the field on 22nd June, and the condition was found to be fairly general throughout the first block of 140 trees examined. Although cultivation appeared not to have been all that could be desired, it could by no means be said to have been neglected. The trees had been manured with farmyard manure, bonedust (which, according to the grower, was of doubtful quality), and superphosphate. In previous years, it is understood, the trees had not received the necessary manurial requirements.

A second block of mandarin trees was examined, but only one tree was found showing disfigurement of the fruit. The conditions under which they were growing were generally comparable with those existing in the former case.

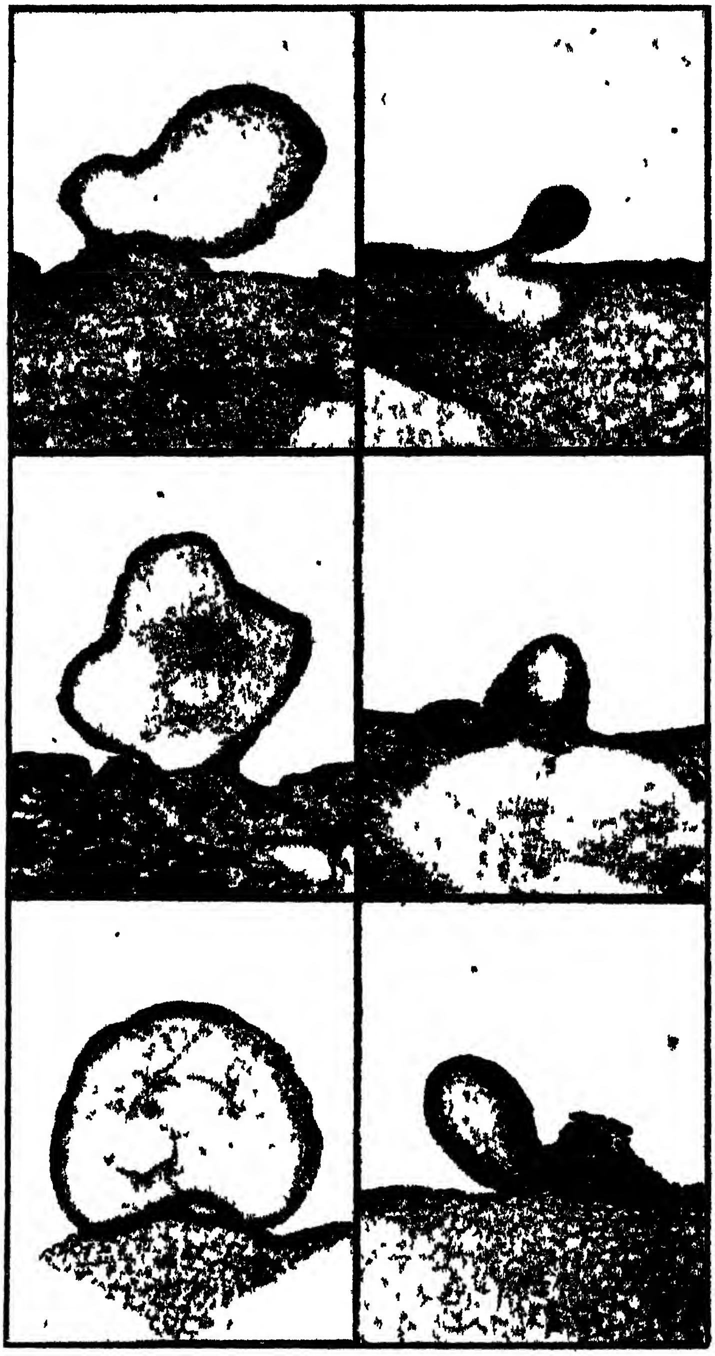


Fig. 2.—Sections through the skin of the fruit, showing different types of outgrowth Magnified 60 times.

The owner of the orchard stated that this was the first time that the trouble had appeared in his trees. Previously they had borne good crops, with fruit of excellent quality. This information was confirmed by Mr. Hunter.

The investigation at Glenorie revealed nothing outstanding which could be looked upon as the cause of the disfigurement of the fruit. The season had been an exceptionally dry one.

On 19th June, 1923, the Fruit Branch forwarded Emperor mandarin fruit, grown at Ebenezer, showing the same condition. The information tendered with these specimens was : "Those on part of limb are from a tree that showed this condition for the first time this year. It is usual for trees the first year only to show a few affected fruit on part of the tree, and after the mandarins have gained a fair size. The following year it is more general throughout the tree, and attacks the fruit at a younger stage, much of which falls off. The tree also becomes hard-looking, the foliage sometimes turns yellow, leaving the network of veins only green. There are about half a dozen trees affected so far in a block of 3 to 4 acres."

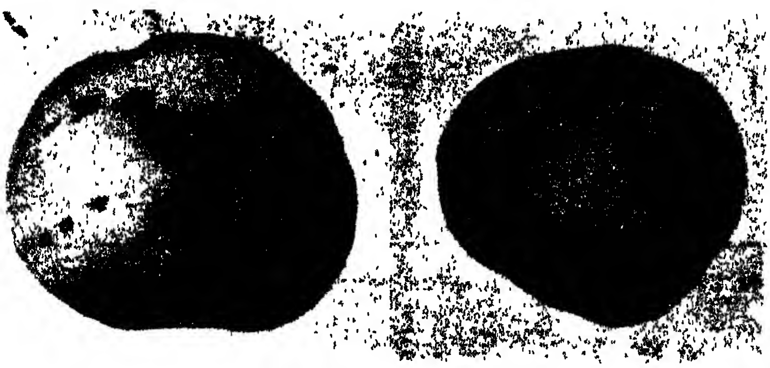


Fig. 3.—Malformed mandarins, showing depressed netted areas

It will be seen from the above information that the condition has been met with in previous years, although this is the first year it has come under the notice of the Biological Branch.

In company with Mr. Spinks, Orchard Inspector, the writer visited this orchard at Ebenezer, and found that a large number of trees were carrying fruit showing the disfigurement. As in the case of the Glenorie specimens, some of the depressions corresponded with the divisions of the fruit. A few leaves showing the condition known as "frenching" were to be found on most trees. This is shown as light-coloured areas occupying the spaces between the veins of the leaves, and is found on trees growing on poor soil, which later develop exanthema.

The trees are about nine years old, and the trouble first made its appearance three years ago.

Associated with this trouble at Ebenezer is another condition, which is quite distinct (see Fig. 3). It presents itself at first as small, reticulated areas; later the oil-glands rupture, forming an ochre-coloured scab (see Fig. 4). The tissues here cease to grow, while those surrounding them expand, causing pronounced malformation of the fruit. In some respects the condition resembles fruit from exanthema trees. The disfigurement was sufficiently bad to render the fruit unsaleable.

Fig. 4.—Showing three stages in the development of the areas. Magnified three times.

The soil on this property is poor sand, very deficient in humus. The writer is inclined to the opinion that the lack of humus and, perhaps, other essential constituents of the soil, due to gradual depletion, is in a great measure responsible for the trouble. He is indebted to Mr. W. J. Reay, Biological Branch, for the photographs accompanying this article.

A Bulletin on the Culture of Cotton.

Few crops have been the subject of such consistent inquiry of late as cotton. In view of the steady demand for information concerning its cultivation, the Department has now added to its series of Farmers' Bulletins one entitled "The Cultivation of Cotton in New South Wales" (No. 150). This publication covers in concise fashion all the main aspects of cotton culture, and should enable any reader to determine whether it promises to be a commercial proposition in his particular situation. The bulletin is well illustrated and contains a useful map. It is obtainable from the Government Printer, Phillip-street, Sydney, for 10d., post free.

The Influence of Season on Cream Quality.

C. J. MACDERMOTT, H.D.D., Senior Dairy Instructor.

It is not always recognised by dairymen or factory managers that the season influences, to a greater or a lesser extent, the quality of the cream delivered to the factory.

Other things being equal, a good normal season tends toward the production of a high-class cream, delicately flavoured, and capable of being manufactured into a high-grade butter. Seasons that are too wet or too dry make it more difficult for the dairy-farmer to produce a high-grade choicest cream; moreover, the natural flavours are not nearly so bright or pleasing. Although the grading of the cream on the platform may be done strictly in accordance with the best principles of high-class butter manufacture, the character of the cream is lacking, and consequently it is reasonable to suppose that the average grade of the butter produced by a factory will be slightly lower when the district is suffering from adverse conditions than it will be when a normal season prevails.

The fluctuation in a factory's butter quality from season to season need not, of course, be due to the influence of the season—the condition of a factory or the methods employed may greatly influence the quality of the product; but where due regard is paid to the proper principles and practices of butter manufacture, the influence of the season on the quality of the produce will be evident. The difference need not necessarily be very marked. It may result in the average grade points for the season being one point under normal, but it is nevertheless of importance, just for that reason. As more provision is made by dairy-farmers to combat abnormal conditions, so the influence of season may be slightly lessened, as far as cream quality is concerned.

The Influence of Dry Seasons.

The two most important features from a cream quality point of view under this heading are (*a*) the water supply and (*b*) the food supply.

One of the first essentials for the production of a high-grade cream is a pure supply of drinking water for the cows. Every grader knows the importance of this. An abundant supply of pure water for dairy cows has a much greater influence on the characteristics of the cream produced than is generally supposed. Even under normal conditions, waters from different sources vary considerably in composition, and consequently their indirect influence on the cream varies also.

When a dry season occurs in the dairying districts, the water supply on most farms is interfered with to a greater or lesser extent. Creeks very often are reduced to a series of water-holes—in aggravated cases, to perhaps only one or two. These are fouled by the cattle when drinking, and soon are in such a state as to make the production of a high-grade cream more difficult. Wells become low and muddy, and often the water may have a distinctly unpleasant odour and taste, which may, directly or indirectly, influence cream quality.

Under dry conditions swamps which in normal times would not be utilised are sometimes brought into use, and although they may be very valuable for keeping the cows alive, they are undesirable in many ways from a cream-quality point of view.

Any condition which interferes with the purity of the drinking water of dairy cows must necessarily influence, either directly or indirectly, the quality of the cream produced. It need not reduce it to a low-quality cream, but it will have at least a slight influence on the flavour. Such cream would fail to exhibit the delicate flavours found in a really high-grade choicest cream.

Not only is the supply of water for the cattle interfered with by a dry season, but the supply of water for cleansing and washing-up purposes at the dairy and bails is very often reduced to a minimum. It is not an exaggeration to say that 80 per cent. of the low-quality cream delivered to butter factories in New South Wales is brought about by the insufficient cleansing of the separator parts, dairy utensils, cans, cow-bails, and the dairy itself. Too much stress cannot be laid on this point, as it is quite impossible to produce a high-grade cream under such conditions.

The cleansing of the utensils and of the dairy buildings is not possible unless plenty of water is available. In many instances a small tank is the only source of supply for washing-up purposes, and in a dry season this soon becomes depleted, and water has to be drawn from the most convenient source. Under such conditions, the supply at the dairy for washing-up is usually totally inadequate for proper cleansing, and in consequence the quality of the cream suffers by contamination from improperly washed utensils. With a depleted water supply, too, there is little or none available for washing down the cow-bails, or at least not daily, and a further source of danger from a cream-quality point of view is introduced.

The question of making provision for a greater supply of water for cleansing purposes is the one that requires urgent consideration by dairymen. An additional tank or two at the dairy or bails would meet the case in most instances. It is all too common, when the rainfall is irregular, to see water being drawn on a slide from the nearest creek for washing-up purposes, whereas a little extra provision would make that quite unnecessary.

The character of the food supply of the dairy cow is generally admitted to have an influence on the flavours associated with a high-grade cream. A good, clean, mixed pasture, on sweet land, is regarded as an ideal medium for the development of high-class flavours in cream, as far as the food supply is concerned. In most instances, pastures represent the bulk of the food supply for the dairy cow, and when the pastures become impoverished, as they do in dry seasons, with continual feeding off, it follows that the flavour of the cream must suffer accordingly, even if only in a small measure. Probably the worst feature associated with a dry, harsh pasture is the fact that cows will seek other food to make up for the deficiency, and consequently will consume all sorts of rubbish, such as suckers and weeds (if available). It is not an uncommon sight in an extremely dry season to see the cows chewing the bark of trees and eating the fungus growth found on logs lying on the ground.

The production of a high-grade choicest cream is impossible under such conditions. It would seem also that cream produced under the conditions mentioned above is less stable and more readily decomposed by the natural influences which affect quality. This fact has not been definitely established, but observations made by the writer point very definitely to such a conclusion. In aggravated cases, where the food supply is very depleted, the cows that are advanced in their lactation period become strippers, yielding only a few pounds of milk each day. It is very often found that half the herd is affected in this manner, and thus half the milk supply is strippers' milk. Such milk is not capable of producing high-grade flavours in cream; in fact, the cream is usually flat and dull in flavour, and makes a correspondingly dull butter.

The dust from the cow-yard is another factor that must be considered under this heading. On some soils this is a real menace during dry seasons. As is well known, this dust is highly contaminated, and when introduced into the milk—by the wind, or from the body of the cow—it causes bad flavours in the cream at a later stage. In several instances second-quality cream has been definitely traced in this State to contamination by a dusty cow-yard. Yards which need paving are always the dustiest, and in wet seasons the muddiest.

The Influence of Wet Seasons.

Just as dry seasons may create an unnatural condition on a farm, causing cream quality to be affected, so will wet seasons very often create certain other conditions which play a part in determining the quality of the cream delivered to the factory. In this case the low-lying farm will come more under the influence of such conditions than the farm situated on undulating or higher country.

Probably the worst feature on a low-lying farm, in a wet season, is the condition of the cow-yard. This is very often a veritable quagmire, where

the cows sink to the hock in slush. Under such conditions clean milking is almost an impossibility, and contamination takes place as the milk is being drawn from the cow. The mud brought in on the udder, flanks, and tail of the cow is very detrimental to the quality of the cream, and unless it is removed thoroughly before milking is commenced, contamination is certain. In wet weather, too, cows very often come in to the bails with water dripping off their bodies, and unless precautions are taken some of it usually drips into the bucket. These two influences cause a good deal of second-quality cream in wet seasons, and are responsible for the common "cow-yard" flavour noticeable in such cream.

Badly-paved milking yards are always a source of danger in a wet season, and are just as troublesome on a volcanic ridge, where the soil is deep and friable, as on low-lying country. The stoning or paving of the milking yards is sometimes a very difficult matter. Some yards would require many tons of stone before the least improvement could be made, and very often there is no material available within reasonable distance. A load of stone occasionally will gradually improve the condition, however, and wherever material is available within reasonable distance, the matter should be given immediate attention.

On low-lying farms there are usually one or more paddocks to which the cows have access which are more or less waterlogged in a very wet season, constituting at these periods what are virtually miniature swamps. A number of instances are on record where such a condition of things was responsible for second-quality cream being delivered to the factory. Swampy conditions of any kind are very dangerous from a cream-quality point of view, and whenever cows have access to swamps trouble may be expected. In a wet season the likelihood of contamination from such a source is considerably increased.

The cartage of cream to the factory is sometimes delayed very greatly in wet seasons on account of the condition of the roads. Some of the roads over which the cream van travels are bad enough in the best weather, and in wet times they are usually in a particularly bad state. This means that the cream is very often delayed and may take just double the usual time to reach the factory. Such conditions help to reduce the quality of the cream, more especially with creams which have started to go back slightly in quality before being put on the van. The friction is increased enormously by the bumping and sliding about on the bad roads.

Conclusion.

An effort is being made to-day to improve the quality of New South Wales butter. In this problem of uplift in quality there are many questions to be considered. The effect of season on cream quality is one of these—perhaps a small one and not the most urgent, but one that must nevertheless be reckoned with. As the dairying industry progresses along sounder lines,

dairy-farmers will, no doubt, make more provision to meet abnormal conditions caused by wet or dry seasons. When this has been done, at least one influence operating to the detriment of cream quality will have been eliminated, with proportionate benefit to the standard of the butter.

The Treatment of Dry Food for Dairy Stock.

During the height of the 1914 Riverina drought, when every vestige of pasture had disappeared, as it can do at such times in that area, and food-stuffs were at a prohibitive price, a large herd of dairy stock was kept alive on treated dry feed in the form of straw chaff and wheaten husks, or so-called beeswing. The feeding was extended successfully over several months, until the drought broke and pasture reappeared.

Needless to say, production was at a standstill; it was a question of keeping the animals from absolute starvation. Stock would naturally hardly thrive on such dry feed alone, so molasses, then the cheapest form of concentrated food, was resorted to. This concentrate was chosen not only because it is highly palatable, but because it is economically transported and handled. and possesses also slight laxative qualities. The last character is of great importance where dry feeding is concerned, on account of the tendency of cattle during dry times to impaction, to which many good beasts succumb.

The molasses was first of all diluted at the rate of one part of molasses to three parts of water, care being taken to mix a sufficient quantity for each beast to get a pint to a pint and a half of the pure molasses itself. The molasses and water was then heated in a big vat by a steam jet, this being a quick and clean way of heating, though any other method will do so long as the fluid is heated to nearly scalding point. Sufficient straw chaff for the day's use was then placed in a convenient heap on a cement or wooden floor, and the hot molasses mixture sprayed on to it from a large rose watering can, and thoroughly incorporated with it by turning the mixture with light, broad shovels. When properly mixed, the mass was neatly heaped up into a pyramid and covered with bags to retain the heat, left for half a day, and then fed. Better results were found by leaving the treated chaff for half a day prior to feeding than by feeding immediately after mixing, as it gave the dry feed a chance to "soften up" in the hot mass.

Those farmers who are fortunate enough to feed ordinary oaten chaff to their cattle should find such a combination with molasses useful, and coastal farmers who have dry roughage in the form of cornstalks could treat the chaffed stalks in this manner also.

Impaction is a common complaint where dry feeding is resorted to, but it is considerably lessened by the use of molasses in the feed as described. —A. T. R. Brown, Senior Dairy Instructor.

The trial of superphosphate as a top-dressing for lucerne was once more tried, and resulted in an increase of nearly £14 per acre from an application of 2 cwt. An experiment to determine the effects of cultivation demonstrated clearly that as well as increasing the yield, cultivation keeps down weed growth.—F. G. Chomley, Manager, Yanco Experiment Farm.

Cotton Experiments on the Upper North Coast.

Cotton experiments were conducted during the past season with the following farmers :—

P. A. Hoare, Coraki.
J. B. King, Dunbible, Tweed River.
M. W. Marks, Leeville.

The season was extremely dry in the early stages and the yields were very small. The variety employed in each instance was the mixed Queensland Upland cotton. The experiments consisted of manurial trials and "spacing" experiments.

The germination at each centre was very satisfactory, but, unfortunately, the stands were so reduced subsequently by the attacks of cutworms and monolepta beetles that it was impossible to obtain true comparative yields.

At Coraki, the land was a light, sandy loam and the crop failed absolutely.

At Dunbible, the crop planted on heavy, rich bottom land was completely destroyed by monolepta beetles, while the plot planted in the second-class, reddish brown, volcanic country gave an ultimate yield of 400 lb. of seed cotton to the acre. This particular plot was planted on 18th October in rows 3 ft. 6 in. apart, the crop being thinned, when 6 to 9 inches high, to about 12 inches between the plants. Very little growth was made, the plants remaining fairly short. The first picking commenced on 5th March.

At Leeville, the land was a fairly heavy black loam. The seed was sown with a maize drill on 20th October, the plants subsequently being thinned to about 12 inches apart. The crop was eaten absolutely bare of foliage during January, but, however, subsequently yielded at the rate of 384 lb. of seed cotton to the acre. The bolls were fairly small, averaging about 90 to 95 to the pound, the average number of bolls to a plant being 16 to 20.

In view of the unfavourable season and the damage caused by insect pests, the yields of 400 lb. at Dunbible and 384 lb. at Leeville were very satisfactory.—E. S. Clayton, Agricultural Instructor.

Spraying Experiments with Apples at Bathurst.

It is well known to orchardists that certain fungicides act better in particular districts than in others. Both Bordeaux mixture and lime-sulphur are effective in the control of black spot in apples, and experiments have been carried out at Bathurst Experiment Farm for a number of years with the object of ascertaining whether an effective control of black spot can be obtained by the use of lime-sulphur in that district. It is also known that some form of sulphur has usually afforded effective control of powdery mildew, and the experiments carried out at Bathurst have shown that that disease can also be controlled there with lime-sulphur.

The trees under trial were not very heavily infected, since the spray control, together with the comparatively dry climate, have prevented the diseases from obtaining a firm hold in the orchard. Nevertheless, it appears from the many experiments carried out during the past three years that in the Bathurst district black spot and powdery mildew diseases upon the apple can be controlled by lime-sulphur applied at the same time and together with the lead arsenate sprays for the control of codlin moth.—G. P. Darnell-Smith.

Orchard Notes.

November.

W. J. ALLEN and W. LE GAY BRERETON.

During the spring months growers of deciduous fruits, especially of apples, pears, and grapes, are particularly busy applying the various sprays, whereas the citrus grower is employed in harvesting his crop. Neither, however, must forget to attend to cultivation. Both spraying and harvesting operations unfortunately involve a deal of trampling of the soil, while showers of rain cake the surface and weeds make a start. All of these conditions are conducive to loss of soil moisture, and it is necessary to correct these conditions speedily—not only to check the loss of moisture with as little delay as possible, but also because of the many other duties that simultaneously call for attention. During the spring and summer the cultivator must often be called into service, because with it the work can be done so much quicker than with the plough. It is essential that the orchard equipment in this respect shall be ample for the area it is called upon to serve.

Pests and Diseases.

In places where codlin moth have been repeatedly bad in past seasons, an endeavour should be made to hand-pick the trees when the first brood of young grubs are entering the fruit. If the trees are gone over and the infected fruit is collected and destroyed by boiling or burning before the young grubs have eaten their way through and left the fruit, a wonderful reduction will be noticed in the later infection.

Care must also be taken to collect and destroy all fallen fruit that is infected with this and other pests or diseases.

The calyx application of lead arsenate is necessarily made while the apples or pears are quite small, but as the fruit grows a greater surface becomes exposed that is not protected by the poison, and it is necessary to spray again. The later applications are sometimes called the "cover sprays," and the first of them should follow the calyx application by about four weeks. A spreader can be added to the lead arsenate to prevent the mixture drying in blotches on the fruit. Soap has been quite extensively used by the Department for this purpose. It not only gives an excellent spread, but also undoubtedly assists in keeping woolly aphis in check on the apple trees, and up to the present it has caused no injury. As has been pointed out before, its use is accompanied with some risk, and care must be exercised in combining lead arsenate and soap in a spray.

The 4 lb. of soap should be dissolved in hot water and diluted with water till it measures not less than 8 gallons. The requisite weight of lead arsenate for 100 gallons is mixed with 92 gallons of water, and the 8 gallons of soap solution is then stirred in, bringing the whole up to 100 gallons.

The spray mixture so obtained should be used at once. On no account should it be left mixed any length of time—even so much as over the dinner hour.

A greater quantity than 8 gallons of water for dissolving the 4 lb. of soap, (up to half the quantity of the total amount of water) would be preferable if not inconvenient.

To save time when spraying a concentrated stock of solution of soap can be made beforehand, using a known weight of a soap in a measured quantity of water, so that the required quantity of soap can be readily measured out and diluted for each load of spray.

Casein can also be used as a spreader for lead arsenate if prepared as follows :—

Casein ...	10 oz
Slaked lime ...	10 oz.
Water ...	1 gal.

Mix the casein with the lime dry; add the water gradually, stirring the while, until the solution is brought to a creamy consistency, taking care that no lumps remain. When mixing 100 gallons of spray, 1 gallon of water is kept out to mix the casein and lime; they are then stirred into the bulk of the spray mixture.

Bordeaux mixture or lime-sulphur at summer strength can be combined with the lead arsenate spray, if necessary, for the control of black spot of apple and pear, but the soap spreader should not be used if lime-sulphur is added. Bordeaux mixture will cause less russeting of the fruit at this period than when applied from pinking to calyx stages, but if the weather is dry and black spot is not developing avoid the use of either the abovementioned fungicides, as their repeated use certainly has a retarding effect on the tree and fruit.

For the control of apple mildew, atomic sulphur, atomised sulphur, or colloidal sulphur can be combined with lead arsenate.

Even where black spot of the grape-vine has not appeared, the vines should be sprayed with Bordeaux mixture (summer strength) to guard against an outbreak of downy mildew, and they should also be dusted with flowers of sulphur where oidium is feared.

Thinning of Fruit.

The thinning of fruit, where it has set too heavily, can now be undertaken in those varieties that have completed their final shedding. This work entails quite a lot of time, but it gets rid of ill-formed fruit, decreases the number of fruit, and in most cases, increases the size of what is allowed to remain; much time is thus saved when picking and packing, and the same number of cases per tree is still marketed as if the trees had been allowed to mature an over-heavy crop of small fruit.

Summer Training.

For the first three or four years after planting and until the lower part of their framework is established, young trees require attention during the growing period.

It often happens that strong shoots start out from various undesirable places on the main limbs and threaten to sap the leaders that are required for extending and developing the framework in the desired direction. Such adventitious shoots should be suppressed. Sometimes, however, accidental shoots can be used to improve the framework, and they should then be retained, being checked by pinching back if they endanger the development of the required leaders. Often, owing to the cutting back in the winter, there will be a superabundance of leaders, and if the tree is too dense for the development and maturing of fruiting members along the main limbs, then some of the superfluous leaders that will not be required for the future development of the framework—as well as some of the laterals, if too many —may be thinned out. However, this should only be done where absolutely necessary and with great caution, as the various growths protect one another, and if thinned out during the growing period to the barest requirements, further losses are very liable to occur from heavy winds. The outside leaders of upright growers will take a more outward or spreading tendency, if the superfluous inside leaders are allowed to remain till the following winter. To insure against such superfluous leaders sapping the desirable leaders, the growing point of the former may be pinched back once, or more often if necessary.

Generally speaking, the whole growth of the tree will be better if not interfered with during the growing period, but care must be taken, as outlined above, that the development is in the desired direction.

A watch will have to be kept over grafted trees or budded stocks that were cut back this spring, and dealt with as described in last month's notes.

Harvesting.

The harvesting of cherries from early districts will start this month. In fact, a few boxes generally arrive on the markets at the end of October. There is some rivalry among growers in an indeavour to be the earliest in placing the first consignment of the season on the market. Though such rivalry is one of the spices of life, growers should guard against marketing fruit which is too unripe. Before it is ripe, the cherry is most unwholesome, and is accountable for quite a lot of sickness among children, and the consumer who experiences trouble at the beginning of the season is quite likely not to buy again for at least that season, and perhaps also to dissuade many of his friends from buying.

The cherry-growers of the northern parts of the State, as a whole, do not put up their crops as well as the growers of the Orange district.

The cherry box ($13\frac{3}{4}$ x $10\frac{1}{8}$ x 4 inches) should be used for the best quality cherries. This box should be made up with the lid fastened down, and the bottom loose. The top tier of the biggest grades is then "rowed" in on the lid, which is marked on the outside, and the remainder of the box is filled in, not rowed, with the same grade of cherry. In districts where skilful packers are not available, the "rowing" may be too slow, or the unskilled may handle the cherry too much, and a very good substitute can be obtained by gathering

the cherries up by the stalks and bunching in the top tier, so that the stalks will not show when the box is open. This method can also be employed for cherries that are not large enough for rowing. When filling in the remainder of the box care must be taken that the whole pack is tight, especially in the corners, so that when the lid is opened the top presents a full appearance with no sunken patches.

Early apricots and peaches will also be ready for marketing during this month, and Valencia Late oranges will not be finished.

Russeting of Apples by Bordeaux Mixture.

Although Bordeaux mixture has in many cases been found to be a more efficient fungicide than lime-sulphur for the control of black-spot of the apple, it has always a tendency to cause russeting of the fruit, this effect being in some cases so marked as to cause serious depreciation in the value of the product. This fact recently led the Department to carry out a series of experiments at Glen Innes Experiment Farm with Bordeaux mixture at different strengths and with the copper-sulphate and lime in varying proportions, with a view to determining what mixture could be used with least detriment in the respect mentioned. The first spraying was at the "pinking" stage, and the second at the "calyx" stage.

The following strengths of Bordeaux mixture applied with a spreader were tested: -3-4-50; 3-4-100; 3-6-50; 3-6-100; 3-9-100; 6-4-50; 6-4-100; and 6-2-50. The varieties of apples used in the experiment were Stone Pippin (four trees), Granny Smith (eight trees), Dunn's (six trees), London Pippin (six trees), Cleopatra (six trees), Fameuse (four trees), Buncombe (eight trees), and Jonathan (six trees). With Granny Smith, London Pippin, Buncombe, and Fameuse, the best results were obtained with 3-4-100 Bordeaux mixture, very little russeting being produced. Both Buncombe and Fameuse appeared to throw off what russeting there was, leaving a smooth surface. Other varieties appear much more susceptible to spray injury. With Stone Pippin a small percentage of the crop was badly russeted with Bordeaux at 3-4-50. With Cleopatra quite half the crop was badly russeted with Bordeaux of the same strength. With Jonathans two thirds of the crop was russeted with Bordeaux at 3-4-50, while with Dunn's even with so weak a strength as 3-4-100 quite half the crop was badly russeted.

The experiment (which is being continued) indicates that to avoid russeting Bordeaux mixture of a strength of 3-4-100 should be used, and that, with varieties susceptible to spray injury (such as Dunn's and Jonathan), a considerably weaker solution of Bordeaux mixture is advisable.—G. P. Darnell-Smith.

Kikuyu and Elephant Grasses at Bellingen.

Mr. A. Wunderlich, of Bellingen, has been growing kikuyu (*Pennisetum clandestinum*) and elephant (*P. purpureum*) grasses. He considers elephant grass a trifle coarse, but it produces a large quantity of feed that can be dried and put aside for winter, when it makes a sweet fodder.

The kikuyu grass has made wonderful growth, and cattle are exceptionally fond of it. He has distributed hundreds of cuttings to farmers in the district, and finds that cows milk exceptionally well when grazing on it.—J. N. Whittet, Agrostologist.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Growers who have crops suitable for seed purposes are invited to communicate with the Department of Agriculture, Sydney. This should be done in ample time to allow of an inspection of the crop to be made before harvesting.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Maize (varieties in order of maturity):—	
Wellingrove	Manager, Experiment Farm, Glen Innes.
Iowa Silvermine	J. Morphett, Farm 863, Stanbridge, *via* Leeton
	P. A. R. Gersbach, Farm 864, Leeton
Funk's Yellow Dent	T. C. Weedon, Beverley, South Gundagai.
	G. Hanneman, Farm 1185, Griffith.
	L. B. Garrad, Milton.
	A. E. Brown, Mt. Keira.
Craig Mitchell	K. W. D. Humphries, Muswellbrook.
Coodra Vale	R. S Lindeman, Coodra Station, Wee Jasper, *via* Yass.
Leaming	E W. Alway, Jones Island, Manning River.
Giant White	J. Ward, Sherwood.
Manning Silvermine	W. J. Adams, Dumaresq Island, Manning River.
Golden Beauty	R. Richardson, Tinonee, Manning River.
	A. M. Hooke, Kootingal, Taree.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy	F. Waters, East Kempsey.
	G. P. Collins, Fairy Hill, Casino.
	J. P. Mooney, Taree
Grain Sorghum :—	
Feterita	Manager, Experiment Farm, Coonamble.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Sweet Sorghum :—	
Early Amber Cane	Manager, Experiment Farm, Bathurst.
Selection No. 34	Manager, Experiment Farm, Yanco.
Potatoes :—	
Satisfaction	H. F. White, Bald Blair, Guyra.
	G. H. J. Price, Yarrowyck-road, Armidale.
Symington	H. F. White, Bald Blair, Guyra.
Millet :—	
Japanese	Manager, Experiment Farm, Coonamble.
Broom	Manager, Experiment Farm, Coonamble.
Lucerne :—	
	W. E. Myring & Sons, "Nungaroi," Pallamallawa.
	A. L. Thomas, "Merrivale," Bedgerebong, *via* Forbes.
Shearman's Clover (Roots) :—	
	J. H. Shearman, Fullerton Cove, *via* Newcastle.
American Pear Gramma :—	
	J. Lambert, Taree Estate, Taree.
Peanuts :—	
Valencia	S. Broom, Farm 1298, Griffith.
Chinese	S. Broom, Farm 1298, Griffith.
White Spanish	S. Broom, Farm 1298, Griffith.
Grasses :—	
Elephant Grass (Roots) ...	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Yanco.
	Principal, H. A. College, Richmond.

Kikuyu Grass (Roots)	Principal H. A. College, Richmond.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm Glen Innes.
	Manager, Experiment Farm, Yanco.

A number of crops were inspected and passed, but samples of the seed harvested hav not been received, and these crops have not been listed.

Observations in the Apiary.

That bees are keenly observant and quickly adapt themselves to abnormal or changed conditions is evident to all practical apiarists. That they are not reflex machines, but can use their brains to work out problems, is also generally accepted. In one case I found a beginner who had placed moth balls in a hive with the idea of keeping out moths and disease. It is a wonder to me that bees and all were not kept out by such an obnoxious substance. Rather than leave their home, however, the bees first endeavoured to dissolve and bite away the disagreeable matter, but evidently this proved beyond their powers of endurance or was not fast enough, so they covered the remaining portions with a film of wax and propolis. Bees do not 'epend on one method to overcome a difficulty.

It is interesting to observe bees gathering nectar or pollen from different species of flowers. They have usually to adopt different methods of obtaining supplies, because of the differences in the construction of the flowers; yet there is very little hesitation on their part in finding out the best way to go about the work. Where the flowers are quite open, one is not surprised to see the bees go to work without hesitation or thought as to the best procedure, but where the bees have to crawl inside the flowers with difficulty, and where it is necessary for the bees to alight on the side of the flower and put their tongue through the petals to obtain supplies, as with *Escallonia macrantha*, they know at a glance how to proceed.

Colour in flowers has not much attraction for the bees, in my opinion, for it is often found that those where the most supplies are found and most eagerly sought by the bees are of a poor colour. The source of supply means more than colour, although the colour of the flowers, each species having a distinctive shade of its own, may be of use in following a source of supply from one plant to another of the same species.

That the sense of smell or organ which detects the scent of flowers is keen in bees is beyond doubt, although scientists have found difficulty in discovering the organ, and in some cases are of the opinion that bees have an extra sense apart from the usual. Some flowers (fresias) were recently placed in a certain room, the only opening being a few inches at the window. The flowers were not there more than half an hour when bees were seen flying about outside the verandah opposite the window; they gradually came closer and finally entered the window, found a way through the curtains, and into the room to the flowers. No human organs could have detected the scent of the flowers at the spot where the bees were first noticed to be attracted. Such a circumstance shows, too, that the scent given off from nectar of flowers in the open would still be within the range of the bees' sense, though at a long distance.—W. A. Goodacre, Senior Apicultural Instructor.

The Queen Bee Competition at Wauchope.

W. A. GOODACRE, Senior Apiary Instructor.

A QUESTION of great importance to the apiarist is how his bees winter, but by close observation and comparison of the various colonies it is possible to detect any weaknesses under this heading, and by means of selective breeding a good deal can be done to procure a better wintering strain. In the Queen Bee Competition which was commenced at the Government Apiary at Wauchope last December, some colonies which were observed to be well advanced during the autumn came through the winter in a more or less weakened condition, while in other hives there was very little loss in bees or vitality, and the colonies made rapid progress in their spring work. In tests for weakness, however, more pronounced results are obtainable in the ordinary apiary than in the competition colonies, because in the latter the strains have already been put through some form of selection in breeding by their owners. The selection now taking place, therefore, is from select stock, and it should be the business of every apiarist to select the best, and then to make further selection from these.

A strain showing a slight weakness in some direction may yet win the competition—perfection is a high standard to attain—but the second best queen may be particularly strong on the point where the other shows weakness, and if in such case we could produce queens from the best and drones from the second best we might hope to breed out the trouble.

The points awarded for wintering qualities in the competition (maximum 100) are as follows:—

F. Coleman.—No. 10, 84; No. 11, 83; No. 12, 92; total, 259 points.
G. G. Phillips.—No. 16, 88; No. 17, 83; No. 18, 84; total, 255 points.
E. J. Gibbs.—No. 1, 84; No. 2, 78; No. 3, 89; total, 251 points.
G. James.—No. 4, 75; No. 5, 84; No. 6, 90; total, 249 points.
Cushan Bros.—No. 7, 83; No. 8, 75; No. 9, 85; total, 243 points.
L. Smart.—No. 13, 73; No. 14, 83; No. 15, 87; total, 243 points.

The spring weather has enabled the competing queens to demonstrate their quality in the brood nest. A number have done beautiful work, showing a capacity for rapid expansion under stimulating conditions. Several, however, have been left behind in the race for progress, and in the final awards for building-up qualities in conjunction with others, a fair amount of variation is expected. No assistance in the way of brood and bees or extra stores has been given to the colonies in their spring work.

Poultry Notes.

November.

JAMES HADLINGTON, Poultry Expert.

On most farms the highest point in egg-production will have been passed by the commencement of this month. Some falling off must be looked for from now onward, but it does not follow that income will be on a lower scale. It is usual for a hardening in prices of eggs to occur in November, in addition to which there will be cockerels to be marketed in fairly large numbers. The Christmas demand will be setting in towards the end of the month, and large numbers of anything approaching prime cockerels will be put in cold storage to meet the demand of the festive season. This, however, can only apply to birds of passable weights, which means from 4½ lb. and upwards live weight. So far, very satisfactory—in fact, fancy prices have been made for small cockerels of much less weight, but they are not likely to be maintained into this month. Usually these very small sorts are a drug on the market before the end of October. The farmer who realises this fact and makes his marketing arrangements accordingly, will be saved much disappointment.

The fact that there has been a considerable falling off in the number of chickens raised this season compared with recent years, and also that the cost of feeding is much lower, will make for better profits from the cockerels. These two facts should be an inducement to rear to a better age a larger number of the young chickens that, regardless of price, are usually thrown on the market at this time of the year with the object of getting them off the farm. It is a questionable policy at any time, but it will be more so this season.

Where the cockerels must be got rid of to make room for pullets—it being a case of reducing stock or of overcrowding—there is only one thing to do. As a matter of fact, in such cases it would have paid better to have hatched less and made the most of the cockerels and pullets. In most instances where such crowding-out occurs it is due to late hatching, the pullets from which are a doubtful paying proposition. Every year one sees many thousands of pullets that have been hatched in October, and even late in September, which have not come on to lay until July, at, say, eight to nine months of age. Such pullets only lay during the cheap season of production, and are rarely ever good layers during any part of their lives.

Here lies one of the causes of low-average egg-production. It is, of course, admitted that under particularly good environment, especially on new ground, late chickens sometimes do better than might be expected, but this is the exception and not the rule under the conditions that usually exist on commercial poultry farms

There are two or three main factors to account for this. They may be set out as :—(*a*) Eggs produced in late September or October are laid at the zenith of the season's production, with the result that the chickens probably do not possess the maximum of stamina to start life with; (*b*) the chickens are run over ground already contaminated by the earlier batches, and are thereby seriously handicapped in regard to environment; and (*c*) the heat of the summer is not conducive to continuous good development in chickens over six weeks old.

Close observation will show that when January is reached there is a very noticeable check in growth in chickens of practically all ages, but other things being equal, it is the most noticeable in the latest batches. The result of this check is that development continues to be slow until the cooler weather sets in about April. Then, just as the pullets would be coming on to lay winter is upon them, another check is sustained, and laying may not eventuate for some months after they are of an age at which they might be expected to come on.

Autumn Hatching.

In response to requests from many poultry farmers to deal with autumn hatching, the following is put forward as the result of experience and observation.

What do I recommend with regard to the second hatching season, generally known as autumn hatching ? The term, " autumn hatching," is somewhat of a misnomer. If a second hatching season is decided upon it should be in the summer, the first batch of chickens being hatched out about the middle of February, and the last towards the end of March. No eggs should be set later than the first week in March. This hatching season is a short one, and should be regarded as a " catch crop " period, rather than as the one for main hatching operations.

The Incidence of Summer Hatching.

After what has been said in the first part of these notes, it might appear somewhat illogical to advocate hatching in February and March, but there are other circumstances to be taken into account. Where summer hatching is decided upon, special arrangements are necessary to success.

1. Breeders that have not commenced to moult should be chosen, and preferably hens that have had some spell from laying between the flush period and the time they are required as breeders. They should be hens that are laying good shelled eggs. Nothing is more indicative of exhaustion than poor shells and small eggs.
2. The ground over which the summer-hatched chickens are to be run should be fresh, or have had at least two or three months spell.
3. It is most unwise to run these chickens on the ground where the main season's rearing is to be carried on. Many a failure to rear the main crop of chickens successfully has been due to continuous occupation of the land by growing stock for the greater part of the year.

It is, of course, understood that the conditions laid down will constitute a barrier to hatching and rearing by many at the time under notice. It is, however, better for the farmer to face facts squarely. The reasons for commencing so early in the summer are that—

1. Eggs are more plentiful in the summer than in the autumn.
2. The chickens hatched out in February and March are not so adversely affected by the heat of summer as are chickens two or three months older, and by the time the babies are i need of cooler conditions the heat of summer is waning.
3. The pullets of such hatching are not expected to lay before August; therefore, the only effect the winter has upon them is that growth is slower and the same size is rarely attained in these as in spring-hatched chickens.

On the average farm, where conditions have been normal in respect of the number of chickens reared in the proper season, it might be questionable practice to go in for summer hatching. There are, however, circumstances under which it might be advisable to go in for this catch crop, more or less; such, for instance, as where partial failure of the spring hatching has occurred, and where the necessary conditions afford promise of success.

The present outlook is perhaps more than ordinarily favourable for this hatching. There has been a big falling off in the number of spring chickens hatched this season, and a dearth of suitable table birds is sure to eventuate after April. The summer-hatched pullets are usually poor layers on the whole, and for the most part are not worth keeping into their second laying period. The prices likely to be realised for cockerels should, however, make this procedure worth while, but only where conditions are favourable. Much, however, depends upon the prospective price of poultry foodstuffs in the New Year—it will be the determining factor in many cases.

One thing is worth keeping in mind; that is, regular supplies will keep up a more constant demand, and do more than anything else to stabilise the poultry industry. The thing that immediately concerns the poultry-farmer is, will it pay? The answer to that is, that it depends upon all that has been put forward above.

Control of Vermin.

The time of the year when red mite may be expected to become troublesome is now at hand. Where there is reason to suspect its presence the perches should be examined—particularly underneath and under the ends that rest upon cleats—when small red insects will often be found in such numbers as to give them the appearance of a semi-liquid substance falling to the floor. These are the suckers, full of the blood that they have extracted from the hen during the previous night. In addition to these visible signs of blood-suckers, there may be swarms of small grey insects. These are the same insects, but in a different stage. In this stage they will be found in almost any part of the poultry house nests and, in bad infestations, even up

in the rafters of the building. The cast skins and excreta will be present in the form of white masses at the entrance, or about cracks and crevices of the woodwork.

There are two ways to effectually rid the poultry houses of this pest—(1), by spraying the houses with kerosene emulsion, and (2), by painting roosts, &c., with blue oil or wood-preserving oil, sometimes known as crude kerosene, or kerosene tar.

The Emulsion.

To make kerosene emulsion, bring to boiling point 1 gallon of soft water and dissolve in it 8 ounces of soft soap; remove from the fire and add slowly 1 gallon of kerosene, stir briskly for ten minutes or more until the oil is thoroughly incorporated with the soap water and appears like thick cream; then add this mixture slowly to 10 gallons of soft water, stirring all the time. Smaller quantities can, of course, be made in the same way.

Rain water stored in tanks, water from the metropolitan water supply, that from most waterholes, and river water in general, is suitable for making kerosene emulsion, but brackish and hard waters are not suitable for the purpose.

To do this work properly, a good force-pump with hose (such as is used by orchardists) is necessary, so that every crack and crevice in the fowl-house can be reached with the kerosene emulsion. Where the infestation is bad, two, three, or even more sprayings will be necessary. One spraying is of little or no use. The sprayings should be given with an interval of a day or two between each, so that any mites that may have been missed by the first spray may all be exterminated.

These measures are equally effective for fowl tick if properly carried out and persisted in.

Export of Fruit to Hong Kong.

Fifty cases of Cleopatra and Dunn's apples were forwarded this season from Bathurst Experiment Farm to Hong Kong for sale and realised £24 7s. 9d., (after paying commission, etc), which was equal to 9s. 9d. per case. Other charges (rail, cartage, and steamer freight) amounted to £16 18s. 1d., equalling 6s. 9d. per case, so that the return was 3s. per case, excluding cost of picking, packing, cases, and cartage from the farm to station.

The agents reported that the apples, although green in appearance, were of excellent flavour and arrived in good condition, but unfortunately there were many more consignments on the same vessel, and four other merchants in Hong Kong received similar parcels.

This points to the disadvantage of individual shipping. If a system of co-operative marketing was in existence, shipments could be regulated so that the market would not be glutted.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

1923.

Society.	Secretary.	Date.
Gundagai P. and A. Society	J. Gardiner	Nov. 14, 15
Adamstown Agricultural Bureau	G. Brock	„ 16, 17
Macleay A. H. and I. Association (Spring Show)	N. W. Cameron	„ 16, 17
Lismore A. and I. Society	H. Pritchard	„ 20, 21, 22
Tweed River A. Society	T. M. Kennedy	„ 28, 29

1924.

Society.	Secretary.	Date.
Albion Park A. and H. Association	H. R. Hobart	Jan. 11, 12
Northern Suburbs A. & H. Association (St. Ives)	F. Conway	„ 11, 12
Dapto A. and H. Society	E. G. Coghlan	„ 18, 19
Kiama A. Society	G. A. Somerville	„ 25, 26
Gosford A. Association	H. G. Parry	„ 25, 26
Wollongong A. H. and I. Association	W. J. Cochrane	„ 31 to Feb. 2
Berry A. Association	G. Gillam	Feb. 6, 7
Tahmoor A. H. & I. Society	E. S. Key	„ 8, 9
Yanco Irrigation Area A. Society	W. Roseworn	„ 12, 13
Guyra P. A. and H. Association	P. N. Stevenson	„ 19, 20, 21
Alstonville A. Society	W. J. Dunnet	„ 20, 21
Pambula A. H. & P. Society	L. K. Longhurst	„ 20, 21
Nepean District A. H. and I. Society	C. H. Fulton	„ 21, 22, 23
Moruya A. and P. Society	H. P. Jeffery	„ 27, 28
Gunning P. A. & I. Society	G. E. Ardill	„ 27, 28
Newcastle A. H. and I. Association	E. J. Dann	„ 26 to Mar. 1
Manning River A. and H. Association (Taree)	R. Plummer	Mar. 4, 5, 6
Tumut A. and P. Association	T. E. Wilkinson	„ 5, 6
Braidwood P. A. & H. Association	R. L. Irwin	„ 5, 6
Yass P. and A. Association	E. A. Hickey	„ 5, 7
Oberon A. H. and P. Association	C. S. Chudleigh	„ 6, 7
Berrima A. H. and I. Society	W. Holt	„ 6, 7, 8
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	„ 11, 12, 13
Mudgee A. P. H. and I. Association	J. H. Shaw	„ 11, 12, 13
Dorrigo and Guy Fawkes A. Association	A. C. Newman	„ 12, 13
Warialda P. and A. Association	Lanagan Bros.	„ 12, 13
Hunter River A. and H. Society (West Maitland)	J. S. Hoskins	„ 12 to 15
Crookwell A. P. and H. Society	C. H. Levy	„ 20, 21
Goulburn A. P. and H. Society	F. D. Hay	„ 20, 21, 22
Rydal A. H. and P. Society	S. Bruce Prior	„ 23
Tamworth P. and A. Association	F. G. Callaghan	„ 25, 26, 27
Narrabri P. A. and H. Association	E. J. Kimmorley	„ 26, 27
Campbelltown A. Society	J. T. Deane	„ 28, 29
Cessnock A. Association	Bill Brown	„ 28, 29
Macleay A. H. and I. Association (Kempsey)	N. W. Cameron	April 2, 3, 4
Blacktown A. Society	J. McMurtrie	„ 4, 5
Camden A. H. & I. Society	G. V. Sidman	„ 4, 5
Orange A. and P. Association	Geo. L. Williams	„ 8, 9, 10
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	„ 9, 10, 11
Royal Agricultural Society of N.S.W.	H. M. Somer	„ 14 to 23
Hawkesbury District A. Association	H. S. Johnston	May 1, 2, 3
Clarence P. and A. Society	L. C. Lawson	„ 7, 8, 9, 10
Murrumbidgee P. and A. Association (Wagga)	F. H. Croaker	Aug. 26, 27, 28
Grenfell P. A. & H. Association	Geo. Cousins	Sept. 2, 3
Cootamundra A. P. H. & I. Association	W. W. Brunton	„ 9, 10
Ganmain A. & P. Association	A. R. Lhuede	„ 16, 17
Temora P. A. H. & I. Association	A. D. Ness	„ 16, 17, 18
Narandera P. & A. Association	W. H. Canton	Oct. 7, 8.

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Agricultural Gazette of New South Wales.

Irrigation Farming in New South Wales.

SUMMER FODDER CROPS.

[Continued from page 787.]

A. N. SHEPHERD, Senior Agricultural Instructor.

THERE is probably no dairyman in New South Wales who will not admit that the growing of fodder crops should be a regular feature of his practice. In almost all parts of the State this applies with particular force to crops for winter and early spring use, but there are many districts where the rainfall is so variable that even in summer the pasture is apt to fall short. In such places cultivated crops are invaluable as serving the double purpose of making green feed available in the summer and autumn, and as producing the maximum bulk of greenstuff, which, if it is not required at once as green feed, can be turned into hay or silage for use at other times in the year.

Especially favoured is the dairy-farmer who has a few acres commanded by irrigation water, for he is able to regard the weather with indifference, knowing that—much as he may value rain as an adjunct to the irrigation supply—he is independent of it, being able to prepare his land, sow the seed, and harvest the crops at the time of the year that is likely to ensure the heaviest yields.

That such resources are not availed of to the extent they might be goes without saying The risks that attach to fodder crop growing apart from irrigation may sometimes be a factor—though often exaggerated—in the neglect of the practice, but where the farmer is able to apply water to his land at will, the possibilities are so great as surely to justify the Department in urging their importance upon farmers.

Last month attention was directed to the utility of the winter cereals for hay and green fodder. This month we turn to those crops that can be used for the production of summer feed.

Maize.

Of all the crops that are available for this purpose, the high feeding value of the fodder and the heavy yields obtained from maize make that crop first in importance.

On the Murrumbidgee Irrigation Areas—as, indeed, in most other parts—the better-class soils give the heaviest returns, while the heavier, tighter clay soils do not suit it so well.

It is usual to sow maize for green feed in the early spring—September and October—to ensure that the feed shall be available in midsummer, and sowings can be continued into November to mature the fodder in the autumn.

No more maize should be sown in December than can be utilised or conserved before frosts occur, for the crop is seriously affected by frost, the fodder being depreciated in quality and the plants eventually killed out.

The preparation of the land should be begun early, the first ploughing being done in June, or at latest July, in order that a period of fallow may precede sowing. If good rains have fallen in the winter and the soil has been well prepared, it should not be necessary to irrigate before seeding, but if the soil is at all dry water will have to be applied. The land should have been graded and check banks thrown up, as described in a previous article, so that watering can be done without furrows having to be run along between the rows of maize.

For green feed, maize should be sown somewhat thickly, as the tendency then is for the stalks to be finer and therefore better feed. The denser growth also shades the ground better and reduces the need for inter-cultivation. It is usual to sow 20 lb. to 30 lb. of seed per acre in rows 21 inches apart, and this can best be done with the ordinary wheat drill, two out of each three hoppers being blocked up and the feed set so that the machine sows one-third of the quantity of seed indicated on the sowing table of the drill. Up to 1 cwt. of superphosphate per acre should be sown with the seed.

Owing to the difficulty often experienced in irrigating the heavy, red clay soils, it may be found advisable to sow double rows of maize 28 inches to 35 inches apart. To do this two hoppers are allowed to sow the seed, and either four or five are blocked to prevent sowing. Furrows may then be run between the double rows and a lead given to the water, so that the plants shall not suffer in their early growth from the ill effects that often follow flooding on this class of land. The surface invariably sets very hard on this soil, and the young plants do not make quick growth and consequently do not shade the land.

The inverted harrow, weighted with a log as described last month, can be drawn over the field after sowing with advantage, the effect being to consolidate the soil round the seed, and thus to improve the percentage of germination and also to make it more uniform.

After the crop is up it should be watered as necessary, from two to four waterings being usually sufficient to mature the crop. On no account should the plants be allowed to suffer from lack of moisture.

If it is intended to use the crop for silage, the plants should be allowed to mature until the grain is in the glazed stage, but if it is to be used for green feed farmers usually start cutting as soon as the plants have made sufficient growth. Though great quantities are fed in the stalk, it is undoubtedly more economical of the fodder to put it through a chaffcutter if one is available.

Usually the crop is cut by hand with a hook, sickle, or cane-knife, the stalks being held in one arm as they are cut and then laid on the ground.

A short brush scythe is also a useful implement. The maize harvester illustrated below is a valuable implement, with the aid of which 6 to 8 acres can be cut in a day, the crop being bound in bundles before being dropped, so that it can be lifted on to the cart or slide with the greatest of ease. No doubt the cost of such a machine is larger than is justified by the requirements of an average irrigation farm, but there is no reason why one should not be owned by several farmers co-operatively, or why one farmer should not procure a machine with the promise of support from several neighbours. Substantial economies in cutting, carting, and stacking or feeding to the chaffcutter could be effected in this way.

Side View of Harvester

When the maize harvester is to be used the maize must be sown so as to allow the machine to pass along the crop without doing harm. It will therefore have to be sown in single rows 3 feet apart, or in the double rows, 35 inches apart.

Carting can be carried out with any suitable farm cart, but the slide is cheap to construct and it minimises lifting.

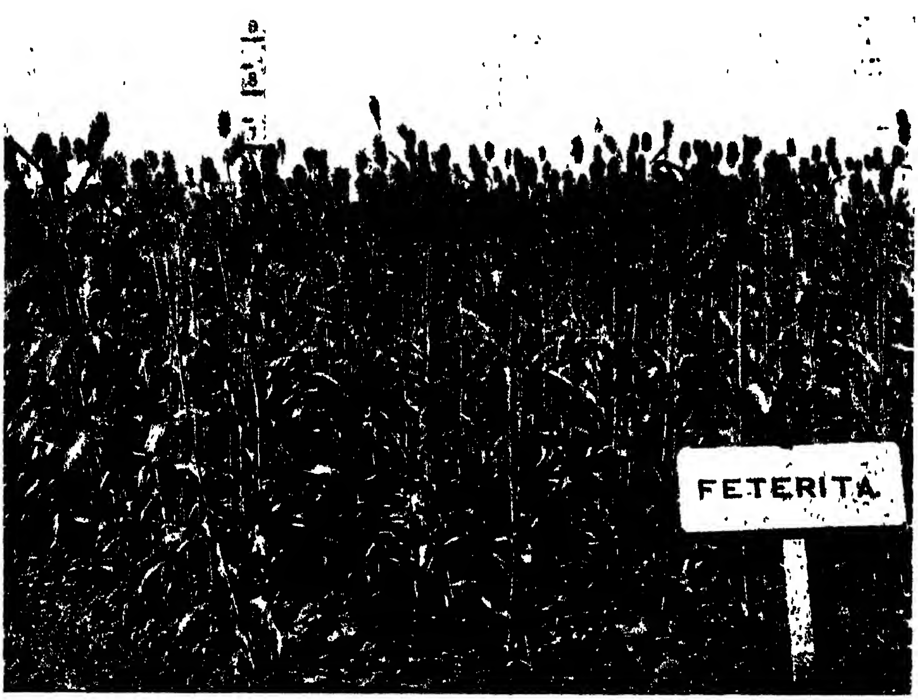
The varieties of maize that can be recommended for fodder and silage purposes on the Murrumbidgee Irrigation Areas are Fitzroy, Large Red Hogan, Large Yellow Horsetooth, and Hickory King.

The Sweet or Saccharine Sorghums.

The essential requirements of a forage crop are that it shall be cheaply produced and easily handled, that the yield shall be large, and that the feed shall be nutritious and palatable. These conditions are probably fulfilled

in the highest degree in maize, but the sweet sorghums have a distinct sphere of utility, and in our dry western districts they resist wonderfully the long spells of dry heat that may be expected in the summer and early autumn, while on the other hand they are not affected by frost to the same extent as maize. Where fodder crops are being grown systematically, therefore, a few acres of one or two of the sorghums are likely to have their value.

The land is prepared as for maize, and the seed sown from October to December to provide fodder from, say, January until early winter. The crop will stand as late as July and still make good fodder.



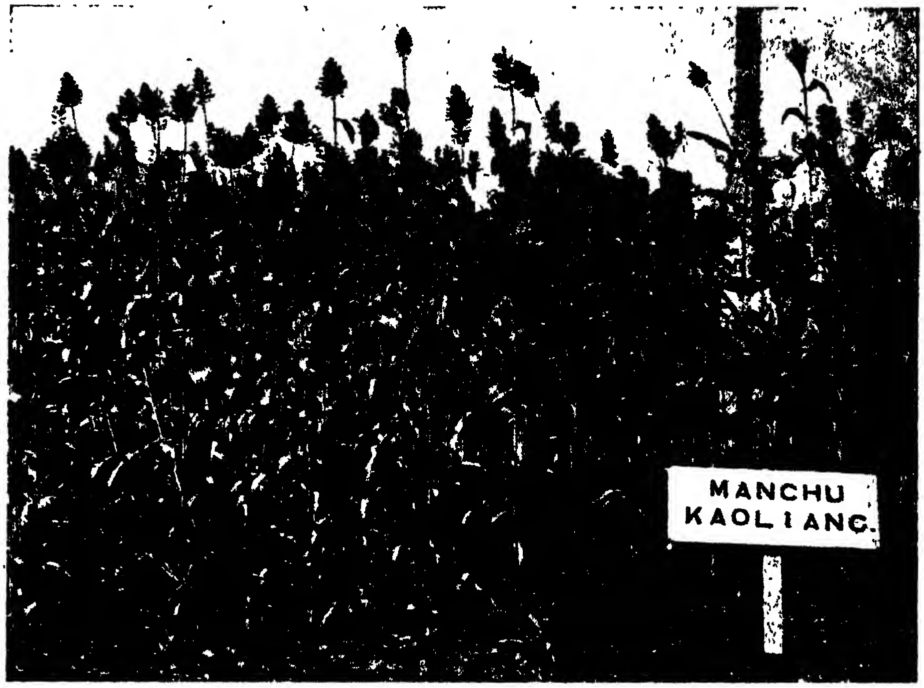
A crop of Feterita which yielded 9 tons 4 cwt. green fodder and 39½ bushels seed per acre.

It is advisable to throw up check banks, as in the case of maize, to facilitate watering. The seed can be sown with the ordinary wheat drill, every second hopper being blocked and the drills set at the slowest speed. When the machine is so adjusted and the seed is sown through the fine side approximately 14 lb. seed per acre is sown. The blocking of the hoppers of the drill is sometimes done with specially prepared pieces of tin, but a handful of ordinary newspaper jammed into the opening serves the purpose equally well, and is the makeshift method adopted by many farmers. Superphosphate at the rate of 70 lb. per acre should be drilled in with the seed.

Several reliable sweet sorghums could be mentioned. Those that do best on the Murrumbidgee Irrigation Areas are Early Amber Cane and No. 61 for early feed, and Planter's Friend, Saccaline, and Orange sorghum (a new

variety) for later purposes. Saccaline can be specially recommended for winter feed, for it withstands frost better than any of the other varieties, and remains in a succulent condition far into the winter.

By judicious selection of two or three varieties it is possible to ensure a succession of green feed that will be particularly valuable on a dairy farm in any dry district. Several varieties can be sown at the same time, and it will be found that Early Amber Cane (as its name implies) will be the first to mature, followed by Planter's Friend or No. 61, while the Saccaline would come in a most useful last.



A good crop of Manchu Kaoliang.

Sorghum crops must be allowed to make good growth before being irrigated, and at no time should the water be permitted to lie on the crop for any time. Subject to the observance of these precautions, the sorghums respond well to irrigation, and as rain is usually infrequent in the autumn constant waterings may be necessary.

The danger of prussic acid poisoning attending the feeding of green sorghums to live stock should not be overlooked. The crop should be allowed to mature before being fed, and stunted growth, such as young sorghum that has wilted as a result of hot dry weather, should especially be avoided, that being a condition that seems to favour the elaboration of the poison. Immature

sorghum that has been frosted should also be avoided. The poisonous substance seems to be greatest in young plants, but it decreases as the plant matures and entirely disappears by the time seed is formed.

It is wisest to cut the crop and allow it to wilt for a day before feeding to stock. This precaution is not essential, but it is advisable to minimise the risks of loss of stock.

The maize harvester or the mower with the back delivery attachment may both of them be used for cutting the crop, and both reduce the labour appreciably, but many farmers adhere to one of the hand implements mentioned in connection with maize.

The Grain Sorghums.

The very useful grain sorghums, the grain of which is specially suitable for feeding to pigs and poultry, grow well under irrigation and give good returns. They are sown in the same way as the sweet sorghums or in rows 3 feet apart. If the latter method is adopted irrigation is carried out by means of furrows, and inter-cultivation can be practised if necessary.

Lighter seeding than with the sweet sorhgums is usual, 6 to 8 lb. being used. If the seed is to be sown in close rows it should be mixed with super phosphate or with sand and then sown through the manure attachment of the drill. If the sowing is to be in rows 3 feet apart, the seed can be dropped through the ordinary wheat hopper.

The varieties most suitable for irrigation lands in our western districts are Feterita, Kafr, and Manchu Kaoliang.

Feterita does not grow quite so tall as the others, but it stands dry weather remarkably well, and yields a heavy crop of grain. Kafir is slow to mature, but under irrigation it is a heavy yielder, though on non-irrigated lands in the west it has given the lightest yields of grain of all the grain sorghums. Kaoliang, which in outward appearance resembles Planter's Friend, and which in eastern lands is frequently called Tall Millet, Great Millet, &c., is the most rapid grower of all. It grows to a good height, with thin stems, and rather sparse leaf, and is all the better if hilled up to help to resist winds.

The grain sorghums may all be said to be notable for their capacity to set grain under most adverse conditions, whether moisture be deficient or even excessive.

On small farms the crop is usually harvested by cutting off the heads by hand and subsequently threshing by hand, though if the grain is being used on the farm on which it was grown, it is commonly fed to the stock without being threshed. The reaper-thresher handles the crops very successfully, and doubtless if a large area were being grown that machine would be used.

The greatest obstacle to the growth of this crop is the sparrow. If allowed to do so, he will take every grain in the crop—and he will do it quickly, too.

The Millets.

The millets have a distinctly useful place among the fodder crops that can be grown on the Murrumbidgee Irrigation Areas, and indeed on most irrigable lands. They are usually sown the first of all in the spring, and they produce an early growth of good fodder. They revel in a plentiful supply of water, and for that reason can be sown on land on which water may lodge at times.

The millet crop lends itself admirably to feeding off, and is a great cream producer.

The seed should be drilled into land that has been well cultivated, and then prepared for irrigation by the construction of check banks. About 6 to 10 lb. of seed can be sown per acre, and 60 to 70 lb. of superphosphate can be applied at the same time with advantage. The seed should be mixed with the superphosphate or sown through the grass seed box.

If the crop is to be fed off, the stock should be allowed on as soon as sufficient growth has been made, but under no conditions should stock be allowed on when the land is wet, or it is likely to "pug" or "bog." In a dry spring the crop will stand quite a considerable amount of irrigation water, and it will be found good practice to turn water on following each time the crop is fed off.

The reaper and binder is the best implement to use in cutting the growth, whether it is to be cured as hay or fed as greenstuff, though the mower is also quite suitable. Millet hay is not looked upon as an ideal fodder for horses, trouble being experienced in certain seasons with what is known as "millet sickness," which suggests that at least it should not be fed in too large quantities to horses and not continuously. It does not appear to affect cattle and sheep in the same way.

Japanese millet has now almost superseded the other varieties in public favour, but Hungarian is also a useful type.

Sudan Grass.

This useful grass now needs little recommendation. It provides good grazing during the hotter months of the year, and makes a good substitute hay when the oaten hay crop fails.

A good firm seed-bed is absolutely essential for Sudan grass, and the preparation of the land should therefore be begun early in the season with a view to good irrigation. The seed should not be sown too early in the spring, or disappointing germination may result on account of the soil not having warmed up.

The seed can be sown by mixing it with superphosphate or with sand and passing it through the manure box of the wheat drill. The rate of seeding varies from 8 to 15 lb. per acre, the larger amount being sown in drills 7 inches apart, with the object of grazing off. Even for hay this is the best method, a better class of fodder with finer stalks being obtained from the thick sowing. Where the intention is to produce seed, it may be sown in

Sudan Grass at Yanco

A Paddock of Sudan Grass at Yanco Experiment Farm.
The hand shows the height of the tallest plant.

rows 3 feet apart through the wheat hoppers. Usually 1 cwt. superphosphate per acre is applied with the seed, and there is ample evidence to show how well worth while is the small outlay involved. Planting too deep should be avoided, 1 to 2 inches below the surface being sufficient under most conditions.

Once it is established, Sudan grass will do with plenty of water, but young plants are apt to scald if the irrigation is done without care in the early stages of the crop.

If it is to be grazed off, the stock should be turned in when it reaches a height of 12 to 18 inches. When it is fed down, the stock should be removed, the land watered, and the crop will be ready for another feeding-off in two or three weeks' time. The grass should not be allowed to come into head before the cattle are turned in, as the stalks then become very tough and a

Sudan Grass (second growth) in the foreground, and Japanese Millet (first cut) in the background, Yanco Experiment Farm.

good deal of feed will be lost. It will be found wise to keep the stock on the crop for an hour or so at a time—say a couple of spells of an hour each per day—as once their appetites have been satisfied they wander about picking at a head here and there, and treading down more than they eat. Sudan grass is very hardy, however, and stands a good deal of rough treatment.

Sudan grass is often blamed for taking too much out of the land. It is even asserted that crops will not grow after it without the land being fallowed first, but in so far as this is true, it is probably because of the treatment the land receives while the Sudan grass is in occupation. If a soil gets plenty of irrigation water, plenty of tramping down by stock, and little or no cultivation—and all this in the hottest part of the year—it can hardly be expected that the next crop will do much good.

Undoubtedly cutting and feeding to the stock is more economical of the fodder, and not so hard on the physical condition of the soil, but it entails more labour, and the farmer must in part be guided by his convenience in choosing the method he will adopt.

Where Sudan grass is grown for the seed, the crop can be harvested with the combined harvester or the reaper thresher, and it can be cut with the reaper and binder and threshed.

In quite a number of cases live stock have suffered seriously after being grazed on Sudan. In some cases trouble has even resulted from feeding Sudan chaff. Investigation has resulted in much of the trouble being traced back to the fact that the grass was grown from impure seed, the crop from which the seed was taken having been grown close to sorghum with which it had become crossed. In many cases, in fact, sorghum seed has been found among the Sudan grass seeds. There is plenty of evidence, in fact, that Sudan grass crosses very readily with the sweet sorghums, and though the result of the cross may increase in vigour, it is also quite commonly a patchy, uneven crop. Farmers therefore require to exercise great care in the purchase of their seed, or, if possible, they should know its origin.

Most of the trouble attendant on feeding Sudan grass to stock, it may be added, has occurred among horses, but with pure seed there appears little danger of poisoning.

The troubles that have attended the feeding of Sudan chaff have chiefly been the result of a too sudden change of fodder, and also of the use of a chaff of inferior quality.

(To be continued.)

"Bunchy Top" in Bananas.

This disease has had a disastrous effect upon many plantations in the Tweed district, and some plantations on the Richmond River have become affected. By the importation of healthy corms from healthy districts, it has been demonstrated that the disease is not due to a "running out" of stock. Further analyses of soil from around healthy and unhealthy plants have been made, and further manurial trials have been carried out. From them it does not appear that the disease is due to the lack of any ordinary soil constituent. The suggestion that the disease is carried by aphides has been tested out, and while spraying plants with kerosene emulsion has kept these pests down, and has apparently to some extent minimised the amount of the disease, it has not yet brought it under control.

Timely action should be taken on the lines recommended by Mr. W. J. Allen, Fruit Expert of the Department, when infection is noted on a small scale, affected plants being completely cut out, and the holes limed and not replanted. The plants cut out should be taken well away from the plantation, and, if possible, completely destroyed by fire—G. P. Darnell-Smith, Biologist.

Glenfield Veterinary Research Station.

DURING the last few weeks the Department of Agriculture has witnessed the completion of a project which, notwithstanding many vicissitudes, has been in view for over ten years. It was on 17th July, 1913, that the late Hon. J. L. Trefle, then Minister for Agriculture, assented to representations made to him by responsible officers of the Department, and approved of steps being taken for the establishment of a station which should be devoted to the study of veterinary diseases in this State. It was on 2nd November, 1923, that the institution—fully equipped according to the most modern standards, and almost fully staffed—was opened by the present Minister, the Hon. F. A. Chaffey, M.L.A.

The interval has been a long one, but amid all the difficulties and delays that have presented themselves in connection with the choice and purchase of the site, the clearing, laying-out and fencing of the area, the erection of the buildings, and the appointment of the staff, the objective has never been lost sight of. Among those who can now view the completion of their efforts with satisfaction, none surely can feel such gratification as the present Under Secretary and Director, Mr. G. Valder, whose devotion to the project has surmounted the many obstacles that have strewn the way.

The problems that await solution and the spheres of usefulness that open up to such an institution as this are almost unbelievably numerous and varied. As a result of diseased and unthrifty conditions in stock, losses hardly less than enormous take place annually even in a land so favourable to animal life as is New South Wales, and an institution that can devote itself to the investigation of the problems may become of the greatest economic significance. There are the known diseases of stock, which demand further research; there are the different parasites of livestock, the effects of which require more careful observation; and there are the preparation of reliable vaccines and serums for various diseases. There are, too, the many new disorders and troubles that continually present themselves; there is the need for greater knowledge of allegedly poisonous plants; and there are the many dietetic and feeding problems that arise from time to time. The programme appears imposing, but it is likely to expand rather than contract.

It was early realised that the selection of a site suitable for such an institution required serious consideration. Obviously it should be centrally situated within easy distance of Head Office, and near to a main line of railway; it should be large enough to allow of a certain amount of feed being grown and to provide small exercise paddocks. and it should be free from liability to flood, and not too closely surrounded by settlement.

With these requirements in view, the Chief Inspector of Stock and his officers inspected a number of places, and eventually they recommended the

purchase of an area of about 112 acres, portion of Messrs. Ross Brothers' historical property at Macquarie Fields, quite close to Glenfield railway station and 4 or 5 miles from Liverpool. The purchase of this area was approved of by the Hon. W. C. Grahame, as Minister, on 3rd April, 1916, and the transfer was completed during the following year.

The site having been secured, a farm foreman was shortly after appointed, and upon him fell the responsibility of clearing the area and of fencing and subdividing it. In all, eleven paddocks have been provided, and about 35 acres have been brought under cultivation, the balance being used for grazing. A double row of pine trees and camphor laurels has been planted along three sides of the station to form wind-breaks, and an avenue of flowering shrubs leads from the main entrance to the laboratory, while a few clumps of native bush have been preserved as shelter for stock. When in the future the visitor remarks upon the convenient lay-out of the whole property and the attractive appearance afforded by the plantations and the avenue, he will be informed that it is to Mr. J. W. Chapman, the first farm foreman, that this pleasing prospect is due.

As the time approached for the erection of the buildings, it was deemed advisable to have the advice and assistance of a competent veterinary pathologist, and on 1st June, 1919, Dr. S. V. Dodd accepted the position of Consulting Veterinary Pathologist. To his practical interest and careful forethought, both in the preparation of the plans and the construction of the buildings, the institution and the Department are greatly and permanently indebted.

Early in the present year it was felt that a stage had been reached at which it was necessary to have the services of a full-time officer to superintend the fitting up of the laboratories, and as Dr. Dodd did not wish to accept the position, applications were invited, as a result of which Dr. H. R. Seddon, of Melbourne University, was appointed Veterinary Pathologist The completion of the whole institution and its equipment has been in his hands, and the reflection forced upon the visitor to-day is that so well has the work of everyone been done, that it would be hard indeed to discover anything necessary to the entire success of the station that has not been fully anticipated and provided for.

The Buildings and Equipment.

The buildings, the erection of which was supervised by (in certain cases they were constructed by) the Works Superintendent of the Department, include the main laboratory building, an engine house, small animal houses, operating room, pens and stalls for large and small stock, stock-yards, incinerator, a four stall stable with silo, hayshed and implement shed adjoining, and residences for the Veterinary Pathologist and the farm foreman. The capital cost of the farm at 30th September, 1923, was approximately £16,800, of which £2,262 was originally absorbed in the purchase of the land, and some £12,000 has been expended on the buildings.

As one is conducted over this very complete and thoroughly modern suite of buildings one cannot but be impressed with the manner in which everything that could serve efficiency has been anticipated. In the general arrangement of the buildings, in their appointment, in every detail of a most extensive and varied equipment this is conspicuous.

The main laboratory building (the central feature of the accompanying illustration) comprises the various laboratory rooms which are situated on the southern side, being splendidly lit, but without the direct rays of the sun. The largest of these rooms is devoted to pathological, bacteriological and parasitological work, benches under the various windows providing for the microscopes, while microtomes, centrifuge, shakers, re-agents, &c., are placed on convenient island benches. Opening off this room is a recess containing incubators, water baths and paraffin oven, and also two other laboratories

Glenfield Veterinary Research Station.

The main laboratory building occupies the left side of the picture, horse and cattle stalls and the incinerator appear behind, and the engine house is on the right. The sheep and pig pens, small animals' house, and operating room are placed behind the engine house and do not appear in the photograph.

for special work—one for serological tests, filtration, &c., and the other for chemical work, glass-blowing, &c., the latter also providing a large fume chamber in which the vapours from evaporations can be properly dealt with. Everywhere there is ample provision for storage of material, specimens, cultures, and so forth; everywhere Pacific maple fittings of finest finish, and everywhere the dust nuisance (a real problem where spotless cleanliness is essential) is carefully minimised.

Opening off these rooms is the "kitchen," where are made the various broths which are used as media for the cultivation of the micro-organism. Autoclaves, steam and hot air sterilisers, and a water distillation apparatus figure among the equipment here.

Other rooms in this building comprise the Veterinary Pathologist's own room (with its library and files of scientific journals), the clerical room, photographic room, and staff luncheon room.

At the rear of the building is the *post-mortem* room, with its special table for small animals and its hoist for large animals. A concrete track leads from here to the stables and to the incinerator, so that a carcase can be transported to and from the *post-mortem* room with a minimum of labour.

The gas used for sterilisers, &c., is petrol air-gas, and electricity for light and power is furnished by a 6-kilowatt (110 volt) automatic set. The water supply is drawn from the Sydney Water Supply and Sewerage Board's mains, and the sinks, &c., in the laboratories and animal houses discharge into special treatment tanks, where the drainage is chemically treated. A septic tank provides for the residences, &c.

Detached from this main building are the other structures already referred to, in addition to which may be mentioned here two special fly-proof isolation pens for work on highly infectious diseases or for fly-transmission experiments.

The farm buildings have already been mentioned. They are most conveniently comprised under one roof, and afford ample storage for fodder and for implements and farm equipment generally.

The staff of the station is as follows:—The Veterinary Pathologist (in charge), a veterinary research officer (to be appointed immediately), two laboratory assistants, a clerk, two animal assistants, and the farm foreman

In addition, in order to provide the fullest co-operation between the Stock Branch and the Research Station, a Government veterinarian has been seconded for duty at the station for the time being to assist in certain investigations at present being conducted in the field and at the Veterinary Research Station.

The Official Opening.

The official opening of the institution took place, as already stated, on 2nd November, under the most auspicious circumstances The gathering included the Hons. F. A. Chaffey (Minister for Agriculture), R. T. Ball (Minister for Works), Sydney Smith (first Minister for Agriculture), A. E. Hunt, M.L.C. (Graziers' Association), and C. J. McRae, M.L.C. (Primary Producers' Union), Messrs. J. B. Cramsie (President, Australian Mea Council), G. H. King (Chairman, Meat Industry Board), G. Valder (Under Secretary and Director of Agriculture), R. H. Cambage (President, Royal Society), H. M. Somer and several members of the Council of the Royal Agricultural Society, Professor Stewart, Professor Watt, Dr. Dodd, and the heads of the various branches of the Department of Agriculture.

After an inspection of the buildings, the Hon. F. A. Chaffey outlined the steps which had led to the completion of the station, which, he said, had been pushed forward by Ministers of all political parties. It was not in opposition to any other veterinary institution in Australia, but was intended to supplement their activities and to work in co-operation with them. If the result of the research was the solution of only one of Australia's many stock problems each year it would justify the expense. The experience of the State in regard to anthrax, and the success with which the ravages of that disease had been reduced to a minimum, was an illustration of what research could do. They were pleased to have with them that day the widow and family of the late Mr. J. A. Gunn, M.L.C. Mrs. Gunn had presented the Government with the formula of her husband's vaccine, which had

been tested by the Department and found to be satisfactory in every respect. A promise had been made that Mr. Gunn's name should be honored in some way, and it was suggested that a portion of the Glenfield laboratory should be called the "Gunn wing" to commemorate the gift. The highly satisfactory manner in which the buildings had been arranged and equipped was largely due to the careful thought and attention of Dr. S. Dodd, of the Sydney University veterinary school. It was with pleasure and with great confidence as to its future usefulness to the State that he declared the station open.

The Hon A. E Hunt, M L.C, who apologised for the absence of Dr. Kater, president of the Graziers' Association, proposed a vote of thanks to the Minister Such an institution had been badly wanted for years. Research work was urgently needed, not only to lessen the losses of individual stockowners, but to reduce the accumulated losses of the State as a whole.

The Hon. C. J. McRae, M.L.C., in seconding the motion, promised to bring the aims and work of the institution before the members of the Primary Producers' Union to ensure appreciation of the experiments that were to be carried out.

After the company had been very hospitably regaled by Dr. and Mrs. Seddon, the proceedings terminated with complimentary speeches, in the course of which Mr. Chaffey stated that he hoped bodies of stockowners, dairymen, &c, would make arrangements to visit the station in parties that could be easily handled, so that they might be fully acquainted with what was being done for their benefit.

Bureau Entertainments and the Amusement Tax.

It was recently decided by the Pokolbin branch of the Agricultural Bureau to organise a dance as a means of popularising the Bureau movement locally, and as the project—the profits from which, if any, were to be devoted to the furtherance of Bureau work—would entail a certain expense, it was considered desirable to charge a fee for admission. The question of liability for the amusement tax was raised, however, and the branch wrote to the Department for information.

The Department of Agriculture promptly put the facts before the Deputy Federal Commissioner of Taxation in Sydney, who wrote as follows:—"With reference to your communication relative to an entertainment to be held at Pokolbin in aid of the district branch of the Agricultural Bureau, I have to advise that entertainments held for partly educational or partly scientific purposes by a society, institution, or committee not conducted or established for profit are exempt from taxation under section 12 (*d*) of the Act." It was added that the entertainment in question had been registered and exemption granted.

While other branches of the Bureau will no doubt note these facts, it will be advisable for them to apply to the authorities for exemption where other similar entertainments are contemplated.

FURTHER EXPERIMENTS WITH CONTAMINATED MILLING WHEAT.

IN the September issue of the *Gazette* was published a report of experiments carried out by the Department in connection with contamination of milling wheat by seeds of Hexham Scent and Bokhara clover. It was there related that the experiments had clearly demonstrated that contamination with even as small a quantity of the weed seeds as 3 per cent. (by count) was detrimental to the flavour of the flour when baked. In view of the economic importance of the matter the experiments were continued, with the object of determining if it were possible to eliminate the effects of such contamination.

The method tried was that known as the "patent sleepy eye" process, which was stated to have been effective in the case of weevily, bunty, and mousy wheat. Six 400-gram lots of wheat were respectively impregnated for a period of one week with 3 per cent. and 5 per cent. (by count) of Hexham Scent, Annual Bokhara clover, and Bi-ennial Bokhara clover seed. The weed seeds were then separated from the wheat and 1 per cent. (by weight) of freshly-burnt ground lime was added to and mixed with each lot of wheat, and allowed to stand for one week in air-tight glass jars. The lime was then removed, and the wheat samples conditioned by the washing process, and subsequently milled and baked into bread.

In the sample contaminated with 3 per cent. Annual Bokhara clover seed. a slight indefinite odour was faintly discernible in the bread, but it could not be positively identified as characteristic of the clover seed; in none of the other cases could it be stated with certainty that the characteristic scent was present in either the dough or the bread. In none of the breads baked (even when stale) was there anything markedly objectionable so far as taste was concerned, and the appearance of the loaves was equal to that of the check control.

The tests indicate that the method outlined will enable a wheat contaminated to the extent of the samples experimented with to be made into flour which will produce satisfactory bread.

CONTINUOUS WHEAT AND ITS RESULTS.

"THE continuous wheat plots are very dirty and practically unfit to carry on." In these words the manager of Cowra Experiment Farm recently report d the present position of a certain experiment area on that farm.

Years ago a rotation experiment at Cowra had to be cut short and started on another part of the farm, for the reason that black oats and Saucy Jack had so taken possession of the "continuous wheat" part of the experiment that, as the manager then reported, "little wheat is now taken from the area, and the weeds have become a menace to the cleared adjoining areas." The Department had set out several years before to prove that continuous wheat is not profitable compared with rotation cropping—even if the rotation is only wheat and fallow alternately—and the black oats and Saucy Jack were not long in proving that the Department's contention was quite correct.

That was ten years ago. To-day another experiment with the same object —the value of rotation farming—is tending to reach the same end, and again prove that wheat after wheat for several years, in addition to being less profitable, results in a dirty farm. Thus dual proof of the soundness of the Department's advice to farmers is forthcoming from the one experiment farm.

Fodder Crops for Dairy-farmers.

Upper North Coast District.

E. S. CLAYTON, Agricultural Instructor.

WITH few exceptions the dairy-farmers on the North Coast of New South Wales have in the past been content to depend entirely upon the pastures for feed, and have made practically no provision for feeding their cattle during periods when feed is scarce, as is the case in winter and during dry spells in the summer.

In the early stages of the development of the North Coast, paspalum played a most important part, but now, under the changed conditions, it has been allowed in many instances to outlive its usefulness. The majority of old-established paspalum pastures consist of a short, closely-matted sod, almost impervious to rain, especially on the hillsides; and are incapable of carrying anything like the number of cattle they originally supported. With the pastures in such a condition, the effects of dry spells in summer are greatly accentuated, while in winter and early spring, when paspalum makes practically no growth, the condition of most of the cattle is deplorable.

The more progressive farmers have recognised the limitations of paspalum pastures, and are taking steps to make provision for their cattle during the period when the pasturage is scarce and innutritious. The increase in land values, together with the adverse seasons experienced recently, have forcibly driven the necessity home to many; but the large majority still adhere to antiquated methods and stand helplessly by while their cattle lose condition each winter with monotonous regularity.

That cattle can not only be kept in good condition during winter, but that the milk and butter production can be maintained is being demonstrated on the most progressive farms. The sooner it is universally realised that cultivated crops must be made use of to supplement the pastures, the better it will be for the whole district as well as for the individuals concerned. That fodder crops can be successfully grown on practically every class of country throughout this district has already been fully demonstrated. The Department of Agriculture has for a number of years carried out on farmers' experiment plots trials with a wide range of crops, and can make reliable recommendations of the practices and varieties that are suited to the district.

On account of the climate of the North Coast and the vigorous growth made by the paspalum, it is practically impossible to get that association of

clovers and pasture grasses possible in cooler climates. While White Dutch clover grows well with paspalum, it affords only a little grazing during late winter and early spring, and then only in a propitious season. Our grazing areas, considered in the light of balanced feeding, are distinctly lacking in protein on account of the clovers falling so far short of requirements. the only solution, therefore, is to give more attention to the growing of leguminous crops, such as lucerne, velvet beans, cowpeas, peas, vetches, and such cultivated clovers as Berseem, Bokhara and Cow grass. While it is impossible to break up large areas of paspalum pasture, it is quite possible and very remunerative to break up small areas periodically, which should be cultivated to crops for a few years and then sown down to grass mixtures, which should include White Dutch and either Bokhara or Berseem clover.

Leguminous Crops.

Lucerne.—The best crops are, of course, produced on the rich alluvial flats bordering the rivers, but lucerne is being successfully grown on a wide range of soils; in fact, provided the soil is fertile, well drained, not too sandy nor too loose and open in texture, there is every prospect of obtaining profitable crops of lucerne in this district. Unfortunately, the " big scrub " volcanic soil of the Richmond River district is too loose and open in texture to produce good crops, except in a few isolated situations.

Sowing should be carried out in April or May, 15 to 20 lb. of seed per acre being sown broadcast on a well-prepared seed-bed. The application of ½ to 1 cwt. of superphosphate at the time of sowing is generally of great assistance in establishing a lucerne stand: subsequent top-dressings early in spring with 1 to 2 cwt. of superphosphate have invariably increased the yields in addition to prolonging the life of the stand.

Velvet Beans.—Although this crop has only recently been introduced into New South Wales, it is giving very promising results on the North Coast. It has given heavier yields than cowpeas, growing luxuriantly even on poor soils, and has the advantage of being a more palatable fodder. The crop is very valuable on account of its particularly high protein content. Velvet beans may be sown with early maize crops, but on account of their immense growth, they should not be sown at the same time nor in the same rows as the maize; it is preferable to sow two rows of maize to one of velvet beans, the beans to be sown six weeks later than the maize. After the harvesting of the maize the paddock is available for grazing.

Not only does this crop afford valuable winter grazing, but its seed is also of great value. It is possible on the North Coast to obtain good crops of seed. The rows should be 3½ to 4 feet apart, with 15 to 18 inches between the beans. Yields of 1,000 to 1,500 lb. of seed per acre may be expected. The seed need not be threshed from the pods for feeding; it should either be soaked for twenty-four hours or crushed into a meal. Velvet

bean meal possesses a very high feeding value; it contains slightly more protein than wheat bran, and as an easily produced concentrate for feeding to dairy cows can hardly be surpassed.

Cowpeas.—This crop can be sown between the rows of early maize immediately after the last cultivation. Another method is to broadcast ½ to ¾ of a bushel of cowpeas with 7 to 10 lb. of millet or 15 lb. of sorghum. Cattle can be accustomed to the crop. Cowpeas also make very good hay, and where lucerne cannot be grown farmers should make more use of the crop in this respect. While the hay takes some time to cure, there is not much chance of spoiling; it will stand more rain than many other hay crops. Cowpeas should be included when maize is being sown for silage. The best varieties are Black and Poona (late varieties), and New Era and Victor (early varieties).

A Fodder Crop at Kyogle.
A Manurial Trial with Florence wheat on Mr. E. Green's farm.

Cereal and Miscellaneous Crops.

Crops of wheat, oats, barley, and rye are so easily and inexpensively produced that it is astounding that any dairy-farmer should not regularly make use of these cereals. Yields of 10 to 12 tons of green fodder per acre can be produced on second-class country, while on the richer soils up to 17 tons per acre have been produced. The most suitable wheats are the early-maturing varieties, such as Florence, Firbank, and Thew, but recently Warden, a later-maturing variety, has given excellent results, and can be recommended for the richer soils. All these varieties are suitable for hay-making, and any of the crop not required for green fodder should be put to that use; in fact, many farmers are making additional sowings with this object in view.

The combination of field peas or vetches with wheat or oats has given increased yields, and in addition the inclusion of the legume greatly enhances the value of the resultant fodder as a food for dairy cows. Experiments have demonstrated that to obtain the best results the wheat should be sown at the rate of 1 bushel and the legume at ½ bushel per acre. Golden vetches should be used in mixtures on the richer soils, while Grey field peas are the most suitable for the poorer classes of land. Two hundredweight of superphosphate per acre can be recommended for winter cereal crops.

Sunrise is the best early-maturing variety of oats, and can be depended upon to produce good crops. Algerian is also a popular variety; it is late maturing, but if planted in February can be grazed several times in the winter, and can then be finally cut for green feed or hay. Barley is a great milk-producing fodder, and, although generally not yielding as high as the other cereals, it is nevertheless of great value on the richer classes of soils. Cape and Skinless are the most suitable varieties. Rye is useful for early green fodder, stands feeding off and is of great value on the poorer soils; it is a very useful crop on the Dorrigo plateau. It must be cut or fed-off while young, as it becomes unpalatable after the heads have appeared.

Insufficient attention is paid to the preparation of the land for wheat in this district. The land should be ploughed well beforehand and cultivated to destroy weeds, conserve moisture and compact the subsurface soil. Wheat requires a firm seed-bed; unfortunately this fact is not always borne in mind, and occasionally one sees farmers reploughing immediately before sowing. In the absence of heavy rain to compact the soil this practice inevitably results in disappointing yields.

Sorghum.—This crop should be more extensively grown on the North Coast than is at present the case. It is a most valuable crop, as being grown during summer and autumn and yielding in the vicinity of 20 tons to the acre, it will stand all through the winter, in our mild climate, except where very heavy frosts are experienced. The best variety undoubtedly is Saccaline; it is late-maturing, exceptionally sweet and succulent, " ratoons " well, lasts well into the winter and is not so liable to leaf blight. Saccaline for winter and early spring feed can be sown on the coast up to the end of February. Sow in drills, 2 ft. 6 in. to 3 ft. apart, at the rate of 8 to 10 lb. of seed per acre. If sowing on newly-ploughed paspalum land, broadcasting the seed at 30 to 40 lb. per acre is the best method. On the Dorrigo plateau, Saccaline is rather late to suit the peculiar climatic conditions; in this locality Early Amber Cane is a better variety, and should be sown in November to provide fodder for winter. Do not feed sorghum until it is in head on account of the danger of poisoning.

Sugar Cane.—Used intelligently, sugar cane is of great value to the dairy-farmer. Alone it is not a milk-producing feed, but it will maintain cattle in good condition. It is very useful for feeding in conjunction with milk-producing feeds. To get the best results it should be chaffed and fed with

concentrates. Cane over twelve months old should not be fed to cattle, as it then becomes rather hard and fibrous. The best varieties for fodder are Soutter's 90-stalk Cow cane, Mahona, Rufus Dia Dia and Lily and Green.

Indian Cane.—In localities where sugar cane cannot be successfully grown, there is certainly a place for Indian cane. This crop will maintain cattle in condition, but is not a milk-producing fodder. Chaffing and feeding in conjunction with milk-producing feeds gives the best results.

Maize.—The need for summer fodder crops is being realised by many North Coast farmers, and for this purpose maize is particularly suitable. Green maize is undoubtedly a great milk-producing fodder, and as large yields are obtained in this district farmers should consider the advisability of making more use of this crop. Fitzroy is the best variety for fodder, by reason of its heavy yield and fine succulent stalks. On second-class country, Hickory King is the best variety. A succession of small sowings should be made to provide a continuous supply. The best time to cut for

Mulga Oats at Kyogle, 1923.

green fodder is when the grain is dented. A few dairy-farmers are finding that it pays to feed 4 or 5 lb. of maize grain daily to each of their best cows. This is a matter that can only be decided by the individual, as it largely depends on the quality of the cattle; however, it is worth consideration in view of the fact that butter is most economically produced when good cows are well fed.

Cowpeas may be sown between the rows of early maize, or Grey field peas between the rows of the late maize, thus affording valuable grazing after the maize is harvested. The practice of sowing rye grass in the maize is receiving

more attention and can be strongly recommended. Italian rye grass at 2 bushels per acre broadcasted in the growing crop about February and covered with the cultivator will furnish excellent winter grazing, and with care will last some time.

Sudan grass has not proved suitable for general use on the North Coast, mainly on account of its susceptibility to leaf blight. However, it is a useful crop during a dry spring or summer, by reason of its drought-resisting qualities.

Millet is a useful, quick-growing, catch crop and should be made use of when feed is scarce during dry spells in summer. If sown early it will provide spring feed, or if sown in January or February it affords excellent early winter feed. The most popular variety for green feed is Japanese.

Elephant Grass.—Used for grazing only, Elephant grass is very valuable. The paddock should be shut up periodically and the grass allowed to attain a height of 2 or 3 feet, when cattle should be turned in to eat it down. Elephant grass, if fed off short in March and then allowed to grow, will provide good winter grazing. It is an advantage to sow Kikuyu grass between the clumps of Elephant grass.

Pumpkins are grown for feed on the North Coast, big yields being obtained. Sowings are usually made in the maize crops. Rape is only used to a very slight extent. Mangolds are receiving a little attention, but are not as yet grown to any extent. Sweet potatoes are used for fodder; the vines make good grazing, while the roots also are used.

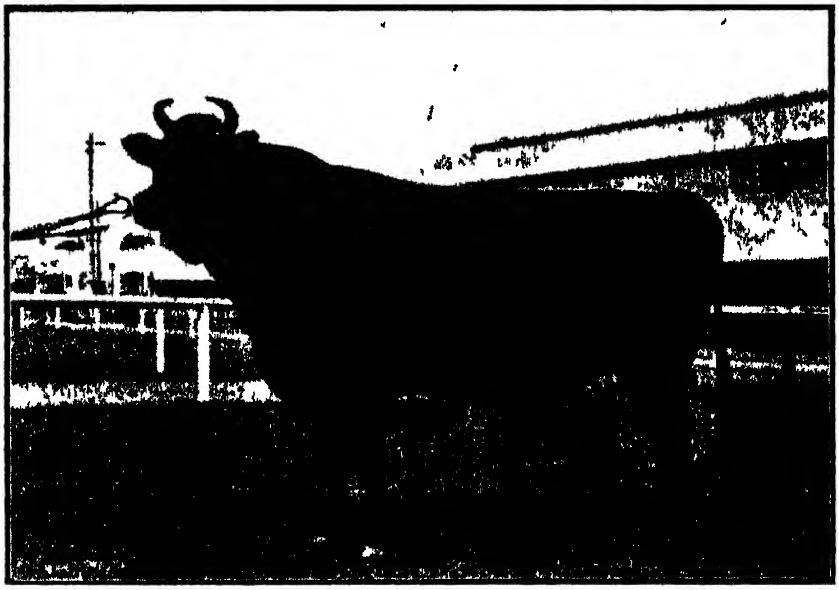
SOWING TABLE of Fodder Crops, Upper North Coast District.

Crop.	When to Sow.	How to Sow.	Quantity of Seed per acre.	Available for Grazing or Cutting.
Maize ...	Sept. to Feb.	Drills 2½ to 3 feet apart.	20 to 25 lb. ...	Dec. to June.
Sorghum ...	Sept. to Feb.	Drills 2½ feet apart Broadcast ...	8 to 10 lb. 30 to 40 lb.	Dec. to Aug.
Sudan Grass ...	Sept. to Nov.	Drills 2½ feet apart Broadcast ...	8 to 10 lb. 12 to 16 lb.	Nov. to May.
Cowpeas ..	Sept. to Dec.	Drills 3 feet apart Broadcast ...	8 to 10 lb. ... ½ to ¾ bus....	Dec. to May.
Millet (Japanese) ..	Sept. to Feb,	Drills 2½ feet apart Broadcast	6 to 8 lb. ... 12 to 16 lb.	Nov. to June.
Mangolds ...	Sept. and Oct. Mar. and April	Ridges, 2½ ft. apart	6 to 8 lb. ...	April and May. Oct. and Nov.
Elephant Grass ...	Sept. to Feb. ..	3 ft. apart each way	Cuttings or roots ...	Perennial.
Sweet Potatoes ..	Sept. to Jan. ...	Drills 3 feet apart	Shoots or plants ...	Feb. to May.
Velvet Beans ..	Oct. and Nov. ...	Drills 3½ feet apart	12 to 15 lb. ...	May to Aug.
Sugar Cane ...	Oct. and Nov. ...	4½ feet apart each way.	Sets	Perennial.
Indian Cane	Oct. and Nov. ...	4½ feet apart each way.	Sets	Perennial.
Pumpkins	Oct. to Dec. ...	10 feet apart each way.	2 lb.	April to Aug.
Wheat Oats Barley ... Rye	Mar. to June ...	Broadcast ...	Alone, 2 bus. With legume, 1 bus.	June to Nov.
Field Peas and Vetches.	Mar. to June ...	Broadcast ...	Alone, 1 bus. ... With cereal, ½ bus.	June to Oct.
Lucerne	April to June ...	Broadcast	15 to 20 lb. ...	Perennial.

Jerseys at Hawkesbury Agricultural College.

J. A. ROBERTSON, M.R.C.V.S., Herdmaster, and GEO. McGILLIVRAY, H.D.A., H.D.D., Senior Dairy Instructor, Hawkesbury Agricultural College.

THE history of the Jersey herd at Hawkesbury Agricultural College dates back some ten years. In 1913 the cattle here were of mixed type and breed, comprising Jerseys, Shorthorns, Kerrys, and grades. It was in that year that it was decided, as a departmental policy, to concentrate the various pure-breds so as to place one breed at each experiment farm. To the College were allotted two breeds—Jerseys and Red Polls—but last year the Red Polls were transferred to Wagga Experiment Farm, and the College herd now comprises pure-bred Jersey cattle only.

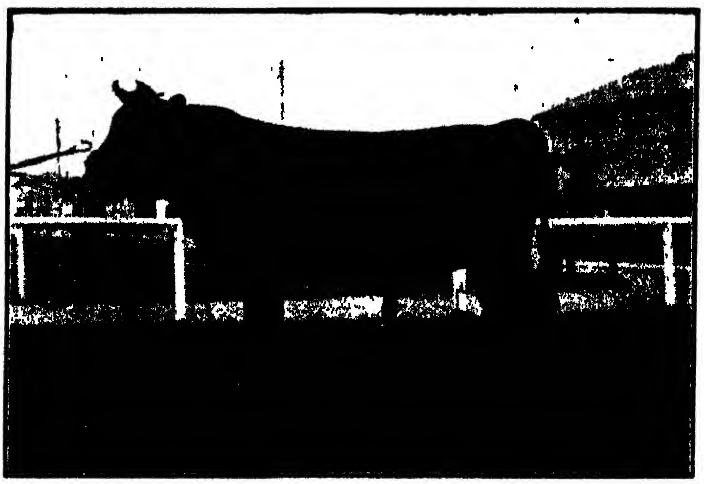


Aster's Diamond King (Imp. N.Z.) (10874).
Sire: Bright Aster (968 N.Z., J.H.B.).
Dam: Squire's Vanity (9164 N.Z., J.H.B.).
For show record and milk yield of dam, see letterpress.

The foundation stock consisted of cattle bred by the Department at Berry Experiment Farm, which had descended from the importations of Jerseys made by the Government in 1898, and of cows originally bred at Wagga and transferred from Wollongbar Experiment Farm, which also possessed a very large infusion of the 1898 blood. In 1914 twelve female Jersey cattle were purchased from the stud of Sir Samuel Hordern, of Retford Park, but only one representative, Retford Minnie, remains in the herd. In the same

year a selection was made from Yanco Experiment Farm of cattle originally descended from stock bred at the farm at Wagga. Included in this lot were four high-quality cows, namely, Wagga Jasmine, Wagga Nuta, Rosette's Heiress, and Bella.

In 1915 a selection of twenty females was made from Wagga Experiment Farm, but this stock was subsequently disposed of, as it included a number of short-pedigreed cows. Another lot of a dozen was transferred from Cowra Experiment Farm in 1918, and these again were mostly of the Wagga Experiment Farm strain. In this lot were several high producing cows, the best being Wagga Adeline. About the end of 1918 a fourth lot of cattle, consisting of about ten head, was transferred from Wagga, which lot included some of the highest producers in the herd of to-day. This lot was followed by two others from the same source—a batch of about ten cows at the end of 1921, and half a dozen in 1922. From the foregoing it will be seen that the Wagga Experiment Farm breeding must be represented in nearly 75 per cent. of the present herd.



Mabel's First Choice of Coraki (1479).
Sire: Retford Mariposa (896).
Dam: Mabel II. of Coraki (5509) by Maitland's Pride (164).
For show record see letterpress.

The Bulls.

On the male side of the foundation stock, the name of the imported bull, Golden Lord (39), sire of some of the best producers and foundation cows in the Wagga herd, stands out prominently. The next conspicuous name in the pedigrees is Kaid of Khartoum (949). He was by Sir Jack (188), a son of the noted imported cow Lady Tidy III. Sir Jack himself was sold at auction at Sydney Show Ground for 175 guineas, and he was subsequently a noted winner at the North Coast shows. Kaid of Khartoum's dam was Egyptian Belle, who can be traced back to the imported cow Egyptian Queen.

Wagga Bashful (3081).
Sire . Kaid of Khartoum (949)
Dam : Wagga Flirt by Coral's Lad (1154).
Yield · 13,200 lb. milk, and 846·79 lb butter in 365 days

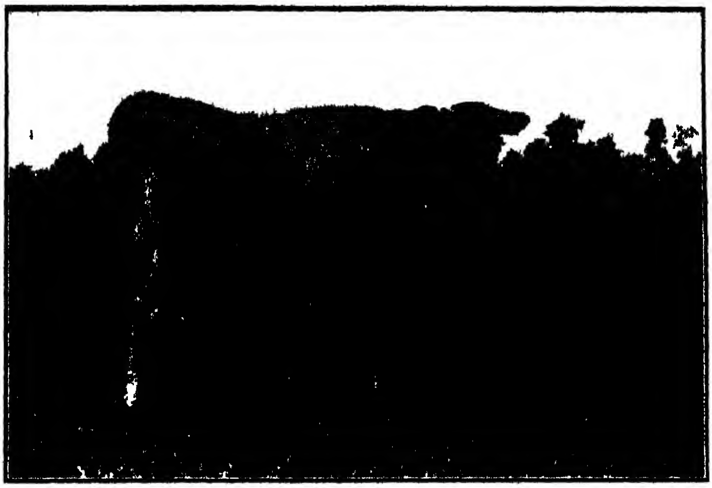
Fancy of Richmond (4820).
Sire : Kaid of Khartoum (949).
Dam ; Wagga Flirt by Coral's Lad (1154).
Yield : 9,620 lb. milk, and 686·38 lb. butter in 365 days

Used contemporaneously with Kaid was Xmas Fox (imp.) (947). This bull was by Silver Fox, a son of the noted bull Black Antimony (imp.). His dam was Malvoisie, a prominent prize-winner at the leading English shows, both in inspection and in milk and butter classes. Janet's Queen IV's Brighton, a grandson of the great sire of milk-producers, Brighton King (imp.), was also in the herd at this time. His stock promised well, but, unfortunately, he was lost early by an accident. He constituted an instance of an animal that turned out well although the production records of his dam were lacking—not that the importance of such records is to be minimised, or that the principle of choosing a bull lacking good production records is advocated.

Following the loss of the bull last mentioned, there was introduced into the herd Lord Silvermine II of Banyule. This was a bull of great substance and type, with ancestry well backed as to milk production. Unfortunately he proved a failure, and practically all his stock has been eliminated. At this period Goddington Noble XV (imp.), bred by Mr. A. Miller Hallett, Chertsford, England, was also being used. He was by Goddington Noble, sold to an American buyer for 500 guineas, and son of Lady Viola, who was also sold to America, bringing £1,400 when 12 years old. Goddington Noble XV's dam was La Franchise III, who was awarded the championship of the English Royal Show of 1913, besides winning numerous other prizes in both inspection and milk and butter classes. Goddington Noble XV himself was awarded third prize at the English Royal Show in 1914 in the yearling class. He was selected for the Department by Mr. C. J. Sanderson when in England purchasing Clydesdales, and the choice was a good one. The progeny of this bull are really the backbone of the present stud, and further advancement in the breeding of high producers will probably be accomplished on the basis of a combination of the blood of descendants of this animal and of Kaid of Khartoum.

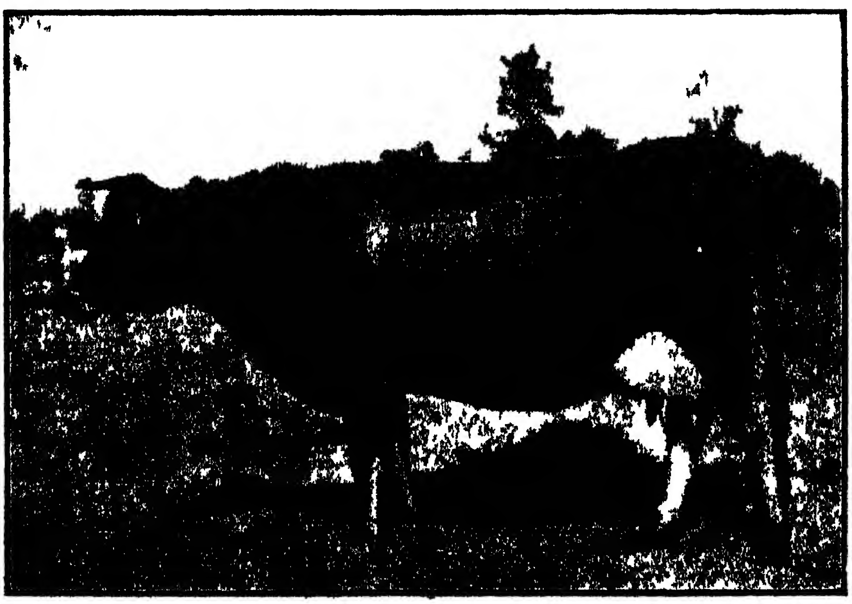
The bulls at present are three in number. Aster's Diamond King (imp.) (10,374 N.Z., J.H.B.) was imported from New Zealand in 1922. He is by Bright Aster, sire of some of the best producing cows in that country, among them being Aster's August Child, who as a three-year old produced 15,301 lb milk and 1,091·07 lb. butter. Aster's Diamond King's dam, Squire's Vanity (9,164 N.Z., J.H.B.), produced 8,470 lb. milk and 565 lb. butter in 365 days as a two-year old. Undefeated as a yearling in New Zealand in the show ring, the imported bull was awarded first prize in a strong class of twenty-seven yearlings at the Sydney R.A. Show in 1922.

The second of the bulls now in use is Mabel's First Choice of Coraki (1479), by Retford Mariposa, from Mabel II of Coraki. Mabel II won several butter test prizes at the Coraki Show. Mabel's First Choice is a bull of robust constitution and good Jersey type. He was awarded the first prize as a



Wagga Desert Rose (3985).

Sire : Kaid of Khartoum (949)
Dam : Wagga Rosa by Colleen's Golden Lad (119)
Yield : 9,482 lb milk, and 545.26 lb butter in 273 days.



Wagga Adeline (1462).

Sire : Golden Lord (Imp.) (39).
Dam : Wagga Judy by Coral's Lad (1154).
Yield : 10,049 lb. milk and 655.44 lb. butter in 365 days.

three-year-old Jersey bull and the championship at the Lismore Show, 1922; and at the Sydney R.A. Show, 1923, he was placed second in the three-year-old class.

Green Farm's Nobleman of Woodside (1301) is the third of the bulls now in use. He was bred was Mr. George Birdsall, of Woodside, Berry, and is by Benedictine's Nobleman (imp.) from Green Farm Dundy (imp.). Both sire and dam were noted and consistent prize-winners at the Sydney R.A. Shows, gaining the highest honours, and his full sister, Green Farm Rose, has a production record of 8,539 lb. milk and 537 lb. butter in 270 days.

Wagga Ariadne (5844).
Sire: Goddington Noble XV (Imp.) (948).
Dam: Wagga Haldee (3989) by Golden Lord (Imp.) (39).
Yield: 12,129 lb. milk and 800 43 lb butter in 365 days.

Local Conditions Affecting Yields.

The conditions that obtain at the College are not conducive to heavy milk and butter yields, the soil being extremely poor and lacking in essential mineral salts. The pastures—which were practically non-existent during last season—are consequently of low-feeding value, making it necessary to hand-feed the cows all through the year; and although the animals are well fed, they cannot be expected to give as good results as if they were grazed on the rich succulent pastures of most of our dairying districts.

The continual changes of milkers, necessitated by the employment of large numbers of students undergoing training, is also detrimental, resulting in unsettled conditions, which tend to upset the highly strung nervous system that characterises all heavy producers, and Jerseys in particular.

All the milking cows are rugged during the coldest winter months, but this trouble and expense has been found to be more than compensated by the increased flow of milk and by the fact that the cows keep in much better condition.

MILK YIELDS of Jersey Cows at Hawkesbury Agricultural College.

Name of Cow.	Sire.	273 Days.		365 Days.	
		Milk.	Butter.	Milk.	Butter.
		lb.	lb.	lb.	lb.
Adeline of Wollongbar (4808).	Maro ...	5,658	397·15	...	...
Trenton's Beauty (4447) ...	Golden Fox (142) ...	6,522	407·03	...	...
Glory Quayle (4822) ...	Xmas Fox (imp.) (947)	8,952	495·48	...	...
Comfort of Berry (4816) ...	do	6,199	440·93	...	...
Bluebell of Berry (4813) ...	do	6,427	413·40	...	...
Retford Minnie (3065).... ...	Minnie's Boy (494)....	7,689	447·77	9,459	559·86
Viola of Richmond (4850)...	Elaine's Heir ...	6,118	411·61	...	...
Rosette's Heiress (4845) ...	do	8,470	575·75	10·057	702·57
Bella of Richmond (4812)...	do ...	7,779	481·12	9,293	591·66
Fancy of Richmond (4820)	Kaid of Khartoum (949)	8,073	509·80	9,620	636·33
Wagga Nuta (2782) ...	Golden Lord (imp.) (39)	7,587	478·68	9,303	610·
Belle of Richmond (5818)....	Kaid of Khartoum (949)	8,059	466·60	9,716	568·21
Wagga Jasmine (2779) ...	do	9,534	722·65	11·864	894·94
Patricia III of Richmond (5841).	Grenadin (imp.) (945)	6,391	402·99	...	...
Adeline II of Cowra (5817)	Trafalgar	10,091	618·61	12,994	831·40
Lady Colleen III of Cowra (4797).	Kaid of Khartoum (949)	6,265	398·33	...	...
Wagga Adeline (1462) ..	Golden Lord (imp.) (39)	8,409	540·2	10,049	682.44
Lady Colleen IV of Cowra (5834).	Trafalgar	6,308	403·8	...	...
Wagga Desert Rose (3985)	Kaid of Khartoum (949)	9,482	545·26	...	...
Wagga Mab (5849) ...	Leda's Retford Pride (608)...	7,290	425·1	...	...
Seaspray II of Cowra (7752)	Xmas Fox (imp.) (947)	6,924	394·23*	...	...
Rosy of Richmond (5843)...	Grenadin (imp.) (945)	5,145	356·27†	...	...
Jessie of Richmond (5833)...	Kaid of Khartoum (949)	6,951	403·45	...	...
Erica of Richmond (5826)...	Xmas Fox (imp.) (947)	7,005	430·5	...	...
Bluebell II of Richmond (5819).	Janet's Queen IV's Brighton (946).	4,941	327·14†	...	...
Bloom of Richmond (7754)	do	6,060	435·14†	7,599	559·07
Wagga Bashful (3981) ...	Kaid of Khartoum (949)	10,265	653·89	13,200	846·79
Noble Mab of Richmond	Goddington Noble XVI (imp.) (948).	5,341	313·78†	...	...
Niad of Richmond (5839) ...	Kaid of Khartoum (949)	8,433	493·65	...	...
Wagga Ariadne (5844) ...	Goddington Noble XVI (imp.) (948).	9,348	599·40	12,129	800·43
Wagga Narcissus (6741) ...	do	7,997	563·77	...	...
Wagga Nan (5852)	Leda's Retford Pride (608)...	7,489	443·45	...	...
Miss Gold of Richmond (7768).	Janet's Queen IV's Brighton (946).	6,226	432·36†	...	...
Wagga Gladys (7778) ...	Goddington Noble XVI (imp.) (948).	7,906	524·12†	...	...
Wagga Joy (6731)	do	7,644	491·75†	9,535	631·39
Lena of Richmond (7765)...	Xmas Fox (imp.) (947)	5,004	313·55†	...	...
Wagga Gladsome (3988) ...	do	8,004	440·76	...	...

* On second calf. † As a 3-year old.

Milk and Butter Yields, 1922–23.

The following figures, which show the returns of the herd for the year ending 30th June, 1923, indicate how good were the results during a poor season, and afford evidence of the high producing standard of the herd :—

Average number of cows milked	51
Average milk yield	7,169·08 lb.
Average test	5·12 per cent. fat.
Average butter-fat production	367·05 lb.
Average commercial butter	442·1 lb.

During the year thirty-five cows completed the nine months' test under the United Pure-bred Dairy Cattle Breeders' Association's scheme. These averaged 6,098·28 lb. of milk, containing 314·85 lb. of butter-fat, equivalent to 379·45 lb. of commercial butter, in 273 days. Five cows completed the

Patricia III of Richmond (5841)
Sire · Grenadin (Imp.) (945).
Dam. Patricia II of Berry by Best Man (220).
Yield 6,391 lb. milk, and 402 99 lb. butter in 273 days.

twelve months' test under the same scheme, and these averaged 8,272 lb. of milk, containing 444·45 lb. of butter-fat, equivalent to 535·5 lb. of commercial butter, in 365 days. The following individual results obtained during the past year are worthy of note :—

Wagga Bashful produced 10,265 lb. of milk, containing 653 lb. of butter, in 273 days. She has since completed a 365 days' test, yielding 13,200 lb. of milk, containing 846 lb. of butter. On the last day of the test she produced 34 lb. of milk, testing 5·8 per cent. butter-fat, equal to 2·34 lb. of butter per day.

Wagga Ariadne produced 12,129 lb. of milk, containing 800 lb. of butter in 365 days, and on the last day of the test gave 28½ lb. of milk, testing 6·1 per cent., equal to 2·08 lb. of butter per day.

Other good yields were recorded, as will be seen from the accompanying table, which also shows that the Jersey is a very persistent milker—so much so, in fact, that it has been found difficult to "dry off" some of the cows.

RECORDS of some of the best Producers.

Cow's Name.	Milk Produced	Butter.	Lactation Period	Produced on last day of Test. Milk.	Butter.
	lb.	lb.	days.	lb.	lb.
Wagga Bashful	13,200·0	846·79	365	34	2·34
Wagga Ariadne	12,129·0	800·43	"	28½	2·08
Wagga Joy	9,535·5	631·391	"	19	1·48
Bella of Richmond	9,293·5	591·661	"	14½	1·1
Bloom of Richmond	7,599·0	559·075	"	13½	1·16
Wagga Bashful	10,265·0	653·0	273	...	...
Retford Minnie	7,689·7	447·778	"	23½	1·7
Wagga Nan	7,489·5	443·454	"	24½	1·6
Miss Gold of Richmond ...	6,226·5	432·368	"	20½	1.5
Wagga Fancy	7,360·5	433·290	"	24	1·5
Niad of Richmond	8,433·0	493·654	"	21	1·2

Apart from the above outstanding cases, the production of the cows under test was high throughout the year, as will be seen from the following table —

ANALYSIS of the production of the Herd.

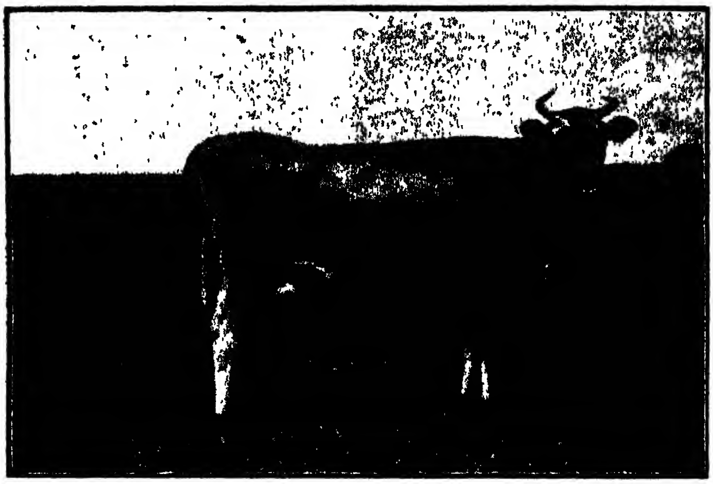
Month.	No. of Cows under Test	Total Milk per day.	Average Milk per day	Average Butter-fat per day	Average Butter per day.
1922		lb	lb.	lb.	lb.
July	38	577	15·18	·829	·998
August	26	496	19	·94	1·132
September	32	714	22·4	1·146	1·38
October.	41	907	22·12	1·228	1·479
November	38	858	22·57	1·06	1·277
December	39	1,010	26	1·28	1·542
1923					
January	42	1,073	25·3	1·238	1·491
February	46	1,184	25·73	1·36	1·638
March	51	1,151	22·5	1·176	1·41
April	48	1,034½	23·2	1·13	1·36
May	47	969	20·51	1·21	1·46
June	44	866	19·68	1·06	1·27

From these figures it will be seen that throughout the year the cows under test averaged 22·01 lb. of milk and 1·36 lb. of butter per cow per day. The table also shows how the production was kept up during the winter months of May and June, 1923, as compared with July, 1922. This was largely due to the co-operation of the Farm Manager of this College in maintaining a good supply of winter fodder crops. The period under review was abnormally

dry from October, 1922, and entirely disappointing from a stock point of view. Considering this and other conditions, the production of the herd must be regarded as very satisfactory indeed.

The Rations Fed.

As previously remarked, the poor quality and feeding value of the College pastures necessitates resort to hand-feeding. To what extent the pasture has to be supplemented by stored fodders and concentrates depends, of



Adeline II. of Cowra (5817).
Sire: Trafalgar of Cowra.
Dam · Wagga Adeline (1462) by Golden Lord (Imp.) (39).
Yield · 12,994 lb. Milk, and 831·40 lb. butter in 365 days.

course, upon the conditions of the paddocks. Some idea of the kinds and amount necessary will be obtained from the following data, which show the average daily ration fed per cow during the season just discussed :—

June-July, 1922.—Maize silage, 30 lb.; lucerne chaff, 10 lb.; bran, 3 lb.; linseed meal, 2 lb.; Sunlight oilcake, 1½ lb.

August, September, October, 1922.—Maize silage, 20 lb.; green barley, (chaffed), 10 lb.; lucerne chaff, 10 lb.; bran, 3 lb.; linseed meal, 2 lb.; Sunlight oilcake, 1½ lb.

November-December, 1922.—Maize silage, 30 lb.; lucerne chaff, 10 lb.; bran, 3 lb.; linseed meal, 2 lb.; Sunlight oilcake, 1½ lb.

March-April, 1923.—Green maize stalks (chaffed), 30 lb.; lucerne chaff, 10 lb.; bran, 3 lb.; linseed meal, 3 lb.

May-June, 1923.—Maize silage, 30 lb.; oaten chaff, 10 lb.; bran, 4 lb.; linseed meal, 3 lb.

In addition to the above ration, some of the highest producers received a mixture of concentrates (crushed oats, maize meal, linseed meal and bran) at the rate of 3 lb. for every gallon of milk produced.

The Pasteurisation of Milk for Cheese Manufacture.

T. H. ATKINSON, N.D.D., Senior Dairy Instructor.

THE application of heat for the preservation of perishable foods was probably practised long before it was known why the process was effective. The reason was not recorded until Pasteur in 1864, in studying the causes of deterioration in beers and wines, discovered previously unknown forms of life which were responsible for the spoiling. He applied heat over a period of time and prevented further abnormal fermentation.

This discovery was termed " pasteurisation," and its first application to milk in a commercial way was recorded in 1880. Since then the principle of pasteurisation has been applied in many ways and on many substances, and types of machines have been evolved to suit each specific purpose. The temperature at which pasteurisation is effective depends entirely on the length of time for which the substance is exposed. Low temperatures require long periods; high temperatures shorter ones. For the purpose of milk pasteurisation, temperatures of 145 deg. Fah. for thirty minutes, and 165 deg. Fah. " flash " have proved to be bactericidally efficient to the extent of 99·94 per cent. in the former and 99·89 per cent. in the latter case. (1)

The introduction of pasteurisation into the butter industry of Denmark was marked by considerable improvement in flavour and general quality, and its introduction later into similar industries in other countries proved most beneficial. In our own State " it is safe to say that the present high quality of New South Wales butter is due mostly to the practically universal use of pasteurisers . . by our leading factories." (2)

The pasteurisation of milk for cheese-making is more recent. In 1898 Klein and Kerstein made a satisfactory Limburger cheese from pasteurised milk, with the addition of calcium chloride and bacterial starter, and the Danes also made good pasteurised skim-milk cheese by the addition of 10 per cent. butter milk of high acidity: other attempts were made in America. In 1907, Dean added $CaCl_2$ and starter to pasteurised milk, and obtained a cheese which was soft and porous in texture and inclined to be weak and open in body, but there was an increase in yield. In 1910, Publow added some valuable information, but reported no success in the finished article. Sammis and Bruhn, in a very comprehensive bulletin (3), published in detail much information on this subject, and although its application has not been proved in every detail, it has generally been accepted and largely used in conducting experiments.

In 1916 Professor Leitch conducted experiments in the manufacture of cheese from vat-pasteurised milk (4) at the Research Dairy of the West of

Scotland Agricultural College, and continued various phases of this experiment during the following years. In 1919 the writer had the privilege of assisting in this work. At the British Dairy Institute, milk was flash pasteurised to 168 deg. Fah., and without using chemicals a satisfactory result was obtained.

Mr. J. G. McMillan, while Dairy Instructor at Hawkesbury Agricultural College in 1910, manufactured 2 tons of Cheddar cheese from vat-pasteurised milk. This was exported to London, and received very favourable comment, being considered equal to the best New Zealand and Canadian product.

The commercial application of the pasteurisation of whole milk for cheese-making probably dates from 1914 when the practice was introduced into New Zealand factories. On account of its many undoubted advantages the new method of treatment was readily adopted. To-day about 80 per cent. of the New Zealand cheese factories pasteurise; in the warmer parts of New Zealand pasteurisation is considered absolutely essential.

For various reasons the introduction of pasteurisation to New South Wales cheese factories was not accomplished until 1921, when the Raymond Terrace Co-operative Dairy and Produce Co. Ltd. and Bodalla Co. Ltd. each commenced turning out pasteurised cheese. Since then other companies have followed a good lead.

The Department of Agriculture has amply demonstrated the benefits of pasteurisation. In addition to the experiments carried out by Mr. J. G. McMillan while on the staff of this branch in 1921, work was done last year by Mr. J. K. Murray (then Lecturer in Bacteriology, Hawkesbury Agricultural College) and the writer to demonstrate further the advantages of pasteurising cheese milk in New South Wales. Notes on the bacteriological aspect of these experiments have been reported elsewhere (1); the practical aspect is now considered.

The Moruya Experiments.

The experiments were commenced at Hawkesbury Agricultural College on 29th May, 1922, and continued for a period of thirteen working days, and the results obtained were verified under factory conditions on the premises of the Moruya Co-operative Dairy Co., Ltd. The object of the experiments was to study the effect of pasteurisation of milk on the quality and yield of cheese made therefrom.

The general mode of procedure was to mix the total supply of milk at disposal, divide it into two equal lots by weighing, and to pasteurise one portion and treat the second portion in the usual way, thus having a basis of comparison. Both types of pasteurisers were available, but on account of the small quantity of milk (370 lb.) pasteurised at one time it was found that the "batch" pasteuriser was most convenient. Consequently the greater portion of the work was done with this machine, employing the generally recognised temperature of 145 deg. Fah. and holding for thirty minutes. Flash pasteurisations at temperatures of 155, 160, 165, and 170 deg. Fah. were also tried.

While fully realising the difficulties that have been experienced in other countries of manufacturing cheese from pasteurised milk without the addition of $CaCl_2$ or acids, it was desired to see to what extent our conditions of climate and surroundings indirectly affected the ability of this milk to assist the coagulation of rennet and the expulsion of moisture. In the cheese factories of this State and in New Zealand cheese is made without the addition of hydrochloric acid. A fairly good coagulum was obtained throughout, but it was found necessary to add quantities of starter to the evening's milk the night before, and also to use greater quantities than would otherwise have been necessary at the commencement of the process. From ½ per cent. to 3 per cent. of starter was used. No additional rennet was necessary, 4 oz. to 100 gallons being used and giving coagulums ready for cutting in thirty to thirty five minutes. The pasteurised coagulum was only slightly slower than the raw where batch pasteurising was done.

PASTEURISED Milk Cheese (145 deg. Fah. for thirty minutes).

	Quantity	Time.	Temperature	Acidity.	Butter-fat.	Remarks.
			deg. Fah	per cent.	per cent	
Milk, mixed	......	......	......	......	4 8	11 lb lost by moisture evaporation. Commenced pasteurising at 8.40 a.m. Heated up in 30 minutes. Cooled in 25 minutes.
Before pasteurisation...	365 lb.	... .	......	......	......	
After pasteurisation ...	334 lb.	.. .	84	......	......	
Starter (acidity ·84 per cent.) added.	4,000 cc.	a.m. 9·45	86	·21	. ....	
Rennet (4 oz to 100 gal.) ...	1¼ oz.	10·30	86	·22	......	
Catch	. ....	13 min.	......	......	......	
Cut curd	. ....	a.m. 11·10	......	·14	......	Good coagulum. Clear whey.
Cook—Commenced	. . . ..	11 20	85	. ....	......	
Finished ...	.... .	11 55	100	·18	......	
Whey run	. ....	p.m 12·45	......	·20	·25	Hot-iron test ¼ in.
" Dry acid "	......	12·55	......	·30	......	Curd drained in vat and turned every 20 minutes.
Milled	......	3 5	93	*	......	Hot-iron test 1¼ in.: good. * No whey exuding for acid test.
Weight of curd	51 lb.	......	......	......	......	
Salted, 3 per cent.	1½ lb.	3·35	84	·86	......	
Hooped	......	3·50	81	·94	......	
Drainings from press ...	1,100 cc.	.... .	......	......	1.5	
Weight of cheese from press (2-6-22)	45½ lb.	... ..	......	......	......	

This curd firmed well in the whey, and after wheying off appeared to be moving slowly. Curd harsh to feel at milling and no loss of whey. Cheese pressed well—good rind The grade note and grader's remarks at time of selling were :—

		Possible Grade.
Flavour	44	50
Body and texture	29½	30
Condition	20	20
	—	—
	93½	100

Remarks.—Flavour good. clean. Body good.

In the case of the cheese pasteurised to 170 deg. Fah. "flash," although the acidity of the milk after pasteurising was ·21 per cent. (calculated as lactic acid), and acidity to ·23 per cent. was developed before adding the rennet, it was forty minutes before it was possible to cut the curd. The curd was very soft, and showed no inclination to mat. Even with an acidity of 1 per cent. at salting there was very little loss of butter-fat or moisture.

The cheeses pasteurised at temperatures from 155 to 165 deg. Fah. were comparatively easy to work. A typical history of the day's working of a flash-pasteurised vat of cheese will be published later. The table and footnote on page 871 is an example of the workings of a typical batch-pasteurised cheese. It was made on 1st June, 1922, as part of this experiment.

The Advantages of Pasteurisation.

Flavour.—The chief selling feature of a cheese is its flavour, so, clearly any process which will improve this quality in cheese should be of decided value. The results given on page 873 of the experiments conducted at Hawkesbury College, show a decided advantage in favour of the pasteurised article. This cheese was graded by Mr. Geo. Stening in Sydney on 5th December, 1922, just prior to selling. It was then six months old, and had been cured at an average temperature of 58 deg. Fah.

The variations in flavour of the pasteurised cheese are, no doubt, to some extent due to variations in the condition of the original milk and to slight alterations in the process of manufacture from day to day, such as for example the incorporation of more moisture or the development of higher acidity. It is a well-known fact that it is practically impossible to get identical results from two vats of cheese treated under exactly similar conditions. When the results are grouped it is possible to arrive at a fair average result.

Pasteurisation is not a "cure-all" for poor quality and badly cared-for milk, but where inferior milk has to be treated, other things being equal, the pasteurised product is of superior quality. The use of a good starter is absolutely essential to the production of good pasteurised cheese.

Body and Texture.—The grade notes given in the table for body and texture leave no room for doubt that pasteurised milk is equally as well suited to the production of these qualities as is raw milk. The weakness in body of the cheese made from milk pasteurised at 170 deg. Fah. was due to the altered condition of the milk during the process. This condition is quite common in milk heated to 170 deg. Fah. and over. Although pasteurised cheese is slow to mature, its keeping quality is greatly enhanced, and frequently this adds to its market value.

Condition.—The condition of the cheese was nearly similar throughout, and all samples were marked alike.

Yield.—With regard to the yield of cheese, the following table shows that the quantity of cheese made from pasteurised milk was greater, except in

GRADING of Cheese made from Pasteurised and Raw Milk, under similar conditions at Hawkesbury Agricultural College.

Date made.	Pasteurisation temperature.									Remarks.
		Pasteurised Milk.				Raw Milk.				
		Flavour (Max. 50).	Body (Max. 30).	Condition (Max. 20).	Total	Flavour (Max. 50).	Body (Max. 30).	Condition (Max. 20).	Total.	
1922.	Deg. Fah.									
29 May ..	145 for 30 min.	43	30	20	93	..	.	...	...	Flavour, clean: body and texture, very good.
29 ,, ...	,,	.	...	.	..	39	28½	20	87½	Flavour, "off"; body, weak; colour, bleached.
30 ,, ..	,,	44	29	20	93	.	..		.	Flavour, clean and mild; texture, trifle open.
30 ..	,,	...	.	..	.	39½	29½	20	89	Flavour, bitter; body, good; colour, good.
31 ,, ..	,,	43	28	20	*91	...	..	...	...	Flavour, clean; body, weak; texture, open; colour, bleached.
31 ,, ...	,,	...	...	.		41	29½	20	90½	Flavour, acid; body, good; texture, open
1 June	,,	44	29½	20	93½	..	.	..	..	Flavour, good, clean; body good.
1 ,, .	,,		..		.	39	28½	20	87½	Flavour, unclean; body, weak, pasty; colour, bleached.
2 .	160 flash	43½	29	20	92½	..		..	..	Flavour, clean; body, weak; colour, bleached.
2 .	,,			.		40½	29	20	89½	Flavour, "off"; body, firm, colour, bleached.
*6 ..	165 flash	.	...	.		..		.	..	
6 ,, .	165 ,,	..	.	...	...	43	29½	20	92½	Flavour, good, clean; body, firm.
7 . .	155 flash	42½	28½	20	91			.	...	Flavour, clean; body, weak.
7 .. .	,,		.	.		41	28½	20	89½	Flavour, acid, texture, short; colour, bleached; cheese heated.
8 .. .	170 flash	41	27½	20	88½	..	..	..	...	Flavour, strong acid; body, weak; texture, short; colour, bleached.
8 ,, ..	,,	.	.	.		40	28½	20	88½	Flavour, strong acid; body, weak; colour bleached.
9 ,, ..	165 flash	43½	29	20	92½	.	.	.	.	Flavour, clean; body weak.
9 ,,	,,	...	...	...	.	40½	29½	20	90	Flavour acid, "off"; body, trifle weak; colour, bright (good).
12 ,, ...	145 for 30 min.	45	30	20	95	...	.	...	...	Flavour, very good; body, firm.
12 ,, ...	,,	...	..	.	.	41	29	20	90	Flavour, fair; body, weak; texture, short; colour, bleached.
13 ,, ...	155 flash	44	29½	20	93½	..	.	...	...	Flavour, good; body, firm; colour, trifle bleached.
*13 ,, ...	..	...	...	...	...	...	...	...	...	
14 ,, ...	145 for 30 min.	42	29½	20	91½	...	...	...	...	Flavour, sharp acid; body, good; colour, slightly bleached.
14 ,, ...	,,	...	...	...	...	41½	29½	20	91	Flavour, slightly bitter; body, firm; colour, good.
15 ,, ...	155 flash	42½	29½	20	92	...	...	...	...	Flavour, clean; body, firm; colour, trifle bleached.
15 ,, ...	,,	...	...	...	...	40	29	20	89	Flavour, acid, slightly unclean; texture fair.

* Cheese not sold in Sydney.

one case, than that made from raw milk. The loss in this single case was in part due to an accident whilst removing the coagulum from the top of the cheese vat immediately after cutting

COMPARATIVE Weights of Raw and Pasteurised Cheese.

Date of Manufacture.	Temperature Pasteurised	Weight after Pressing		Weight on 16th June		Weight on 11th July	
		Raw	Pasteurised	Raw.	Pasteurised	Raw	Pasteurised.
1922	Deg. Fah.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
29 May	145 for 30 minutes	42 0	44 0	39 12	42 0	39 0	41 4
30 ,,	,,	43 0	44 0	42 0	42 2	41 4	41 4
31 ,,	,,	42 0	41 0	41 12	40 10	41 0	40 0
1 June	,,	44 8	45 8	43 0	43 14	42 5	43 2
2 ,,	160 flash	41 0	43 0	40 6	42 4	39 9	41 4
6 ,,	165 ,,	40 0	46 8	39 4	45 12	38 4	44 7
7 ,,	155 ,,	42 0	44 0	41 3	42 8	40 6	41 6
8 ,,	170 ,,	44 0	51 0	42 6	49 6	41 6	47 14
9 ,,	165 ,,	41 0	41 0	40 2	40 2	39 1	39 1
12 ,,	145 for 30 minutes	41 0	42 0	41 2	41 6	40 0	40 2
13 ,,	155 flash	42 0	42 4	41 8	41 12	40 1	40 8
14 ,,	145 for 30 minutes	41 0	42 0	40 14	41 9	39 14	40 2
15 ,,	155 flash	40 10	42 8	40 10	42 8	39 2	40 12
Total				533 15	555 13	521 4	541 4

It will be observed that on 16th June, pasteurised cheese showed a total gain of 21 lb. 14 oz., or 3·97 per cent., over the raw milk cheese. On 11th July these figures were respectively 20 lb. and 3·9 per cent.

There was very little difference in the quantities of starter used in the raw and pasteurised milk on the same day, although in some cases the latter had a slight advantage. After due allowance is made for this addition, it is obvious that pasteurisation has caused a fairly big increase in yield.

It might be noted here that the pasteurised article loses weight faster than the raw milk cheese. This is to be expected on account of the higher moisture content, where the loss of moisture only is responsible. It is nevertheless true that pasteurised cheese stands much warmer temperatures, and under these conditions, where the raw milk cheese is losing fat as well, pasteurised cheese has the advantage. The loss in quality on this count is, to a slight extent, also avoided.

The quantity of milk used each day was 730 lb., half of which was from a Jersey herd. The average test of the mixed milk was 4·6 per cent. butter-fat. Half this quantity—or 365 lb.—was pasteurised and half manufactured in the usual way. The total result from each vat was made into a single cheese.

Literature Cited.

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[3] Sammis, J. L., and Bruhn, A. T.—The Manufacture of Cheddar Cheese from Pasteurised Milk (Univ. Wisconsin Agr. Expt. Sta. Res. Bull. 27, 1912).

[4] Leitch, Renwick H.—2—Manufacture of Cheese from Vat-pasteurised Milk (West of Scotland Agr. College).

(*To be continued.*)

The Bureau in Co-operation with Agricultural Societies.

A very useful co-operation between branches of the Agricultural Bureau and local agricultural societies has resulted in much more valuable and interesting displays in the agricultural sections of a good many district shows during the last few years.

One of the first agricultural societies to realise how great could be the value of such effort was the Berrima District A. and H. Society, which offers £50 and a challenge shield for competitive displays of farm produce staged by branches of the Bureau at the annual show at Moss Vale. Many branches of the Bureau hold fortnightly competitive displays, others seasonal displays, and others run their own annual shows; but organised efforts extending over the whole year, and aimed at demonstrating the production possibilities of the district, have resulted in most striking and valuable displays at certain country shows. Such exhibits serve also as a recruiting ground for the huge district exhibits at the Sydney Royal Show. At Candelo, Moss Vale, Orange, West Maitland, Taree, and the Hawkesbury District shows, among others, some striking exhibits have been staged. The Hunter River A. and H. Society and the Taree Society each offer 100 guineas for competition.

This aspect of Bureau work is facilitated by the experiment plot system which is carried out by the Department of Agriculture in co-operation with branches, and also by the departmental arrangement for the distribution of seeds, &c.—C. C. Crane, Organiser of Agricultural Bureau.

A Grazing Proposition for Irrigable Country.

The experience of the past season of grazing sheep on lucerne in small paddocks of 2 and 4 acres indicates that this is a reliable and profitable means of utilising irrigable country on which a fair stand of lucerne can be grown, in conjunction with some elevated dry country, on which the sheep may be depastured during winter and fed, if necessary, with lucerne hay.—F. G. Chomley, Manager, Yanco Experiment Farm.

IMPORTS AND EXPORTS OF FRUIT.

THE following table compiled by the Government Statistician shows the imports and exports of fruit, dried and processed, during the quarter ended 30th September, 1923:—

Description.		Country of Origin.	Imports.	Exports.
Interstate—				
Fresh Fruit	cases	.. ..	535,001	149,793
Pineapples	centals	....	....	....
Melons	doz.	... ...	....	....
Canned Fruit	lb.	. .. .	21,268	700
Dried Fruit—				
Unspecified	,,	. ...	18,228	532
Currants	,,	....	7,616	308
Raisins	,,	.. ..	12,908	56
Apricots	,,	. ...	6,356	. ...
Apples	,,	.. ..	6,776	.. . .. .
Prunes	,,	.. ..	7,864	28
Pears	,,	. ...	.. ..	.... ..
Sultanas	,,	....	7,420	....
Peaches	,,	.. ..	168	....

Returns of Exports to Queensland during August and September are overland only.

Description.		Country of Origin.	Imports.	Exports.
Oversea—				
Fresh Fruit—				
Citrus	centals	... ...	43	10,305
Apples	,,	.. ..	....	1,364
Pears	,,	....	. .. . .	158
Pineapples	,,	. . ..	28	4,142
Bananas	,,	... .	47	. .. ...
Other	,,	.. ..	52	14,187
Dried Fruit—				
Apples, pears, peaches, &c. ..	lb.	U.S.A. . .	625	.. . ...
Apples	,,	....	.. ..	897
Apricots	,,	....	....	955
Currants	,,	Greece	539	29,912
Prunes	,,	U.S.A. ...	27,533	1,116
		France	2,240	....
Peaches	,,	....	....	1,208
Raisins—Sultanas ...	,,	....	....	5,729
Lexias	,,	....	....	140
Other	,,	Greece	517	764
Dates	,,	Mesopotamia ...	155,852	17,401
Other	,,	United Kingdom ..	2,195	4,523
		China...	16,729	....
		Greece	1,239	....
		Mesopotamia ..	2,848	....
		Spain	935	....
		U.S.A.	760	....

Oversea imports and exports of fruit and vegetables preserved in tins are not included.

Diseases of the Cotton Plant.

[Concluded from page 810.]

W. A. BIRMINGHAM, Assistant Biologist, and I. G. HAMILTON, B.Sc., British Australian Cotton Growing Association, Limited.

LAST month the physiological and bacterial diseases of the cotton plant engaged our attention. This month we turn to the fungoid diseases, of which there are quite a number.

Anthracnose (*Glomerella gossypii* Edg., syn., *Colletrichum gossypii* South.).

Cotton anthracnose, boll-spot, or boll-rot occurs throughout the cotton belt in the United States, where its seriousness varies according to the season.

It is a serious disease on cotton in the Philippines, while in Egypt it is not serious though it is very common. Mr. W. L. Waterhouse has recorded it from Hawkesbury Agricultural College. In America the annual loss is estimated to amount to several million dollars. Wet seasons are very favourable to the spread of the disease. The damage which the disease is responsible for includes the killing of seedlings, the entire and partial destruction of the bolls, the discolouration of the lint, and injury to the stems and boll pedicels. Occasionally the loss on individual farms is as great as 80 or 90 per cent., while on adjoining places little trouble is experienced.

Recognition.—The parts of the plant on which the disease manifests itself are the bolls (Fig. 4), the young seedlings, the stems, and the boll pedicels. The boll injury is probably the most serious. At first small reddish or reddish-brown spots with a slight shrinking of the tissue in the centre may be observed. The spots gradually change, the centres becoming black, while the rims remain reddish. The spots may coalesce until they involve a large portion of the boll. If the bolls are attacked young they may be peculiarly dwarfed, or may crack open exposing the immature fibre to the weather and further destruction. When more mature bolls are attacked, only a part (one or two loculi or divisions) may be destroyed.

Fig. 4.—Boll attacked by Anthracnose.

In young seedlings anthracnose has a "damping off" effect, attacking the young plants at about the surface of the ground and causing them to collapse.

When the boll pedicel or stalk is attacked the result is usually the falling off of the boll. Stems frequently develop lesions due to anthracnose attack.

Cause.—The causal organism is the fungus *Glomerella gossypii* Edg. It propagates itself by two kinds of spores, one of which is responsible for the characteristic pink colouration Anthracnose is spread by insects and by the wind, and it is also carried in or on the seed. Spores of this fungus are left in the cotton gin by badly diseased lots of cotton, the result being that seed otherwise free from the disease becomes infected.

Controls.—1. Use disease-free seed for planting; that is, seed from a field free from disease.

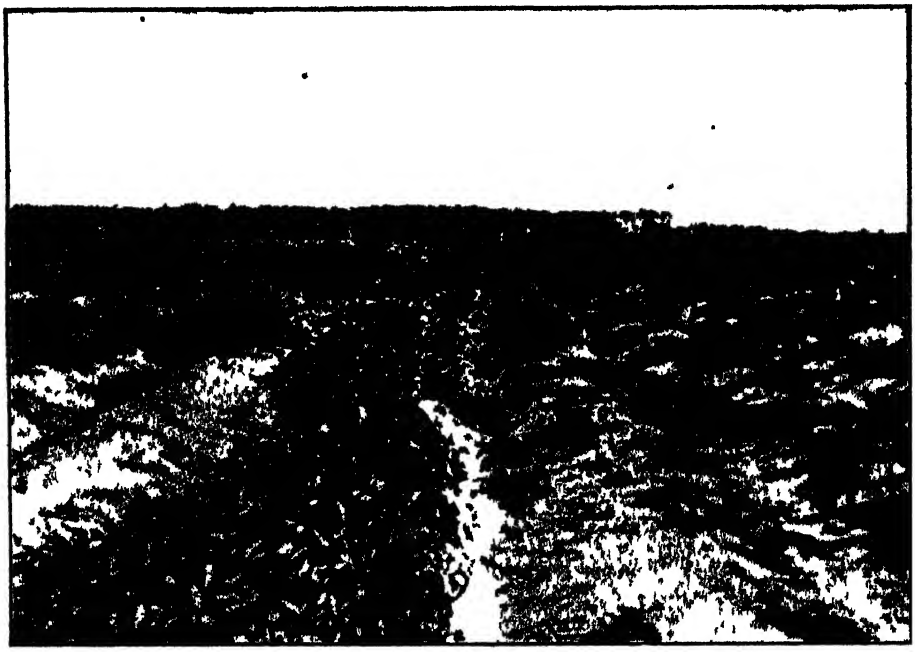

Fig. 5.—Sea Island Cotton, a variety resistant to Wilt Disease.
The result of selection from resistant plants [After Orton.

2. Crop rotation—a two-year rotation is necessary to free the field entirely of disease.

3. Seed treatment with sulphuric acid and mercuric chloride is useful for small lots of select seed. It is too expensive for general use.

4. Grow varieties least troubled by the disease. No commercial varieties are known which are absolutely resistant, but a number are known which are not troubled by it to any great extent. Harland, referring to the various cotton plants he grew in the West Indies, says: "Certain of the types of cotton grown at the Experiment Station show resistance to the angular leaf disease which is quite definitely genetic. What must be aimed at is to synthesise (breed) a new type of cotton, combining the desirable qualities of Sea Island cotton with the disease resistance of these otherwise undesirable varieties."

Cotton Wilt or Black-root (*Fusarium vasinfectum* Atk.).

Wilt occurs to a greater or less extent in every cotton-producing State in America. Its attacks have been most serious in the sandy soils from Virginia to Texas. The amount of damage which it is responsible for varies in different seasons, it being more severe in wet seasons than in dry ones. In severe cases the yield is reduced as much as 75 to 90 per cent. Gilbert estimates than the annual loss in the American cotton belt due to wilt amounts to at least ten million dollars.

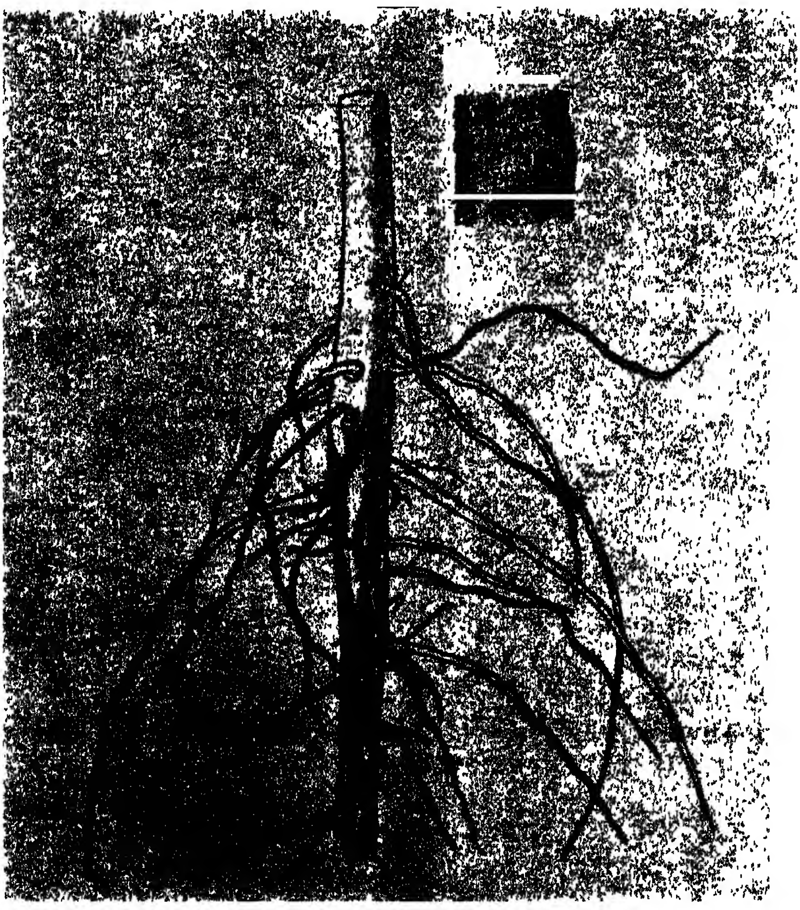

Fig. 6.—Cotton Root-rot.

Affected plant with bark removed from base of stem and roots, x $\frac{1}{3}$. Above, part of surface of wood showing sclerotia of Rhizoctonia, x 2.

[After Butler.

Recognition.—When the leaves of the cotton plant wilt and fall without any apparent reason, black-root or wilt is to be suspected. If the interior of the stem or root of a freshly wilted plant is found to be browned or blackened, the disease is almost sure to be wilt. A dwarfing of the main stem is also characteristic of the disease. Affected plants ultimately die (see Fig. 5).

Cause.—The causal organism is *Fusarium vasinfectum.* The fungus gains entrance into the roots from the soil, usually by means of an injury. It grows in the large vessels of the root and stem, blocking them up and causing them to turn black. The blocking of the vessels is the direct cause of the external evidence (the wilting and dwarfing) of the presence of the disease, as the free interchange of raw food material and manufactured food between root and stem is thereby interfered with. The fungus reproduces itself by several types of fruiting bodies, and its dispersal may be carried out by the wind blowing the spores, or by soil, parts of affected plants and other material containing spores and mycelium being carried from field to field. Gilbert carried out tests, and found that cotton seed does not spread the disease.

Fig. 7—Southern Blight.
Note the small brown seed-like sclerotia on carnation

Control.—Several varieties have been bred out in America which are absolutely resistant to wilt. Such varieties are Dillon, Dixie, Dixie Triumph, and Dixie Cook. As the fungus is capable of living as a saprophyte on the decaying vegetable matter in the soil for from seven to ten years, the practice of a suitable rotation between these resistant varieties and other crops is the only satisfactory way of finally freeing the soil of the organism.

Texas Root-rot of Cotton (*Ozonium omnivorum* Sh., syn., *Phymatotrichum omnivorum* (Shear) Dugger).

Gilbert (1921) says that "in Texas, root-rot is the most destructive disease of cotton, some planters regarding it a more serious menace to the crop than the cotton boll weevil. In 1906 the loss in Texas was estimated at 52,600 bales, or 1·3 per cent. of the crop."

Recognition.—The first indication of the presence of this disease is the sudden wilting of one or more cotton plants. The roots are at first covered with a whitish mould, which later becomes yellowish-brown. The tap-root is usually attacked first, at a point near the surface of the ground. It is quite common to find the tap-root entirely dead owing to the ravages of the disease, and a single abnormally developed lateral root supporting the plant.

Cause.—The fungus responsible for the disease is known as *Ozonium omnivorum*. It lives in the soil, spreading underground from plant to plant, and penetrating the roots and causing the wood to turn black. The fungus appears to grow best where the soil aeration is poorest. Warm weather following rain is especially favourable to the spread of the disease.

Control.—No very satisfactory methods of control are known. The best method is probably the practice of a three-year rotation, combined with deep ploughing in the fall. *Ozonium omnivorum* attacks a large number of other plants besides cotton, so that immune crops must be used in the rotation. Among the immune crops are maize, sorghum, millet, wheat, oats, and other grasses.

Fig. 8.—Leaf-spot (*Cercospora gossypina*).

Sore-shin (*Rhizoctonia solani* Burt., syn., *Corticium vagum* P. and C. var. *solani*).

Sore-shin or damping-off is one of the diseases of lesser importance in the United States, whereas in Egypt it is the only serious fungoid disease of cotton. It has long been known in Europe, and is also known in North and South America, the West Indies, India, and Australia.

Recognition.—Sore-shin attacks the plants in the seedling stage, causing cankerous spots on the stems and roots. The spots result in a cessation of growth, in the yellowing of the leaves, and, if they encircle the stem, in death. Sometimes two or three replantings may be necessary (see Fig. 6).

Cause.—The causal organism was first described as a species of *Rhizoctonia* by Atkinson in the United States in 1895. It is now recognised as being identical with the organism which attacks potatoes as *Corticium vagum*. *Corticium* is capable of passing long periods of time in a resting stage, produced by forming small dark knots of twisted mycelium. Balls worked out the relationship of the fungus to temperature, finding that below 33 deg. Cent. (equal to 91 deg. Fah.) the fungus grows freely, but above this temperature its growth becomes gradually slowed down until completely arrested.

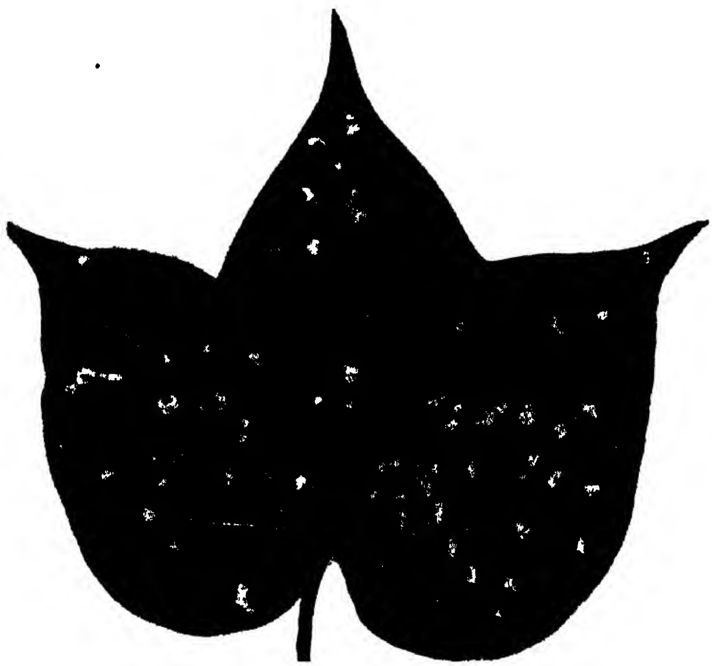

Fig. 9.—False or Areolate Mildew.

Control.—As temperature above 33 deg. Cent. arrests the growth of the fungus, it is important that sowing should take place when there is every chance of warm weather ensuing immediately after sowing to give the seedlings a good start. Treating the seed with 2½ per cent. of its weight of naphthalene mixed with gypsum as a cement is found to prevent an initial attack of sore-shin on the seedlings.

Internal Boll Disease.

This disease is especially prevalent in the West Indies, and according to Harland is the most important factor in causing boll-shedding. The evidence of the presence of the disease is the gross staining of the lint in the unopened bolls, often followed by more or less rotting of the boll contents. The organisms responsible were examined by Nowell, who found in the great majority of cases that one or more of four fungi were responsible, and in some cases one or more species of bacteria. Nowell had described these four fungi and temporarily distinguished them as A, B, C, and D.

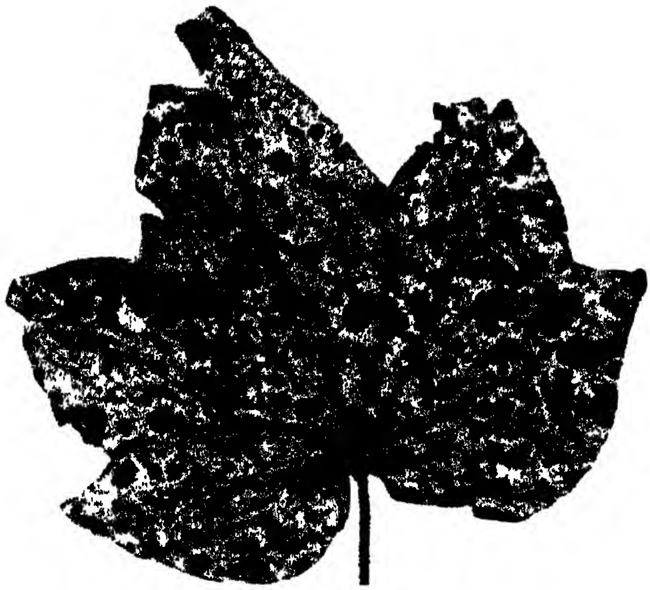

Fig. 10.—Alternaria Spot on Cotton Leaf.

Experiments showed that the disease is dependent for infection upon the punctures of plant bugs, and evidence supports the opinion that the infecting organisms are carried by the bugs themselves.

Southern Blight (*Sclerotium rolfsii* Sacc.).

Southern blight is found on a large number of host plants as well as cotton in the Southern States. Affected plants lose colour, wilt, and may die. The causal fungus—*Sclerotium rolfsii*—is found around the base of the stem, and

on the roots, where one can recognise it by the dense mass of mycelium covered by a large number of the characteristic small, brown spherical bodies known as sclerotia (see Fig. 7).

Black Rust, Leaf-spot or Blight (*Macrosporium nigricantium* Atk.), (*Cercospora gossypina* Cke., syn., *Sphaerella gossypina* Atk.).

Leaf-spot is not of any great importance economically. It is more common on the less vigorous or old leaves, and is generally reported as prevalent when for any reason the vitality of the plant is lowered. The spots are at first small and red, later becoming pale, and finally brown at the centres. They are generally up to a quarter of an inch in diameter, but sometimes confluent and extensive (see Fig. 8).

False or Areolate Mildew (*Ramularia areola* Atk.).

This disease is of minor importance on cotton in India, the United States, the West Indies, and South Africa.

Fig. 11.—Alternaria Spot on Bolls.

The causal organism—*Ramularia areola*—occurs chiefly on the older leaves as the plants reach maturity. It forms irregular pale translucent spots, from one-sixteenth to half an inch in diameter, and with a definite margin formed by the veins of the leaf (see Fig. 9). Later the leaf turns yellowish-brown, and a whitish, frosty growth appears, chiefly on the under surface, but occasionally also above.

Rust (*Uredo gossypii*, syn., *Kuehneola gossypii* (Lagerh) Arth.).

Rust is a widely-spread disease, being known to occur in India, Ceylon, Java, West Africa, the West Indies, North and South America, New Guinea, and the Philippines. It appears to do very little damage, attacking chiefly sickly plants, which may be defoliated. Infected leaves are entirely covered on both surfaces with minute brownish to black pustules.

Diplodia Boll-rot (*Diplodia gossypina*).

This fungus has been responsible for up to 10 per cent. loss in some fields in Louisiana. It gains entry to the boll by means of insect injuries or wounds, but is not able to attack uninjured bolls. The bolls when first attacked become brown and later turn black, and are coated with a powdery mass of spores. The entire boll rots and the fibre is blackened and decayed.

Where the disease becomes serious, rotation of crops is recommended.

Fusarium Boll-rot (*Fusarium* sp.).

Bolls injured by insects or other diseases are attacked by this fungus, which can be recognised by its pink covering of spores produced over the entire surface of the affected area. Young seedling plants are also attacked.

It is not important except in wet seasons, when it may be prevalent. The fungus is carried in the seed and lives over winter in the field.

A species of *Fusarium*, similar to the above and recorded elsewhere, has been found in New South Wales

A wilting of cotton seedlings has also been found in the State, associated with which a species of *Fusiarum* has been repeatedly found.

Alternaria Leaf-spot (*Alternaria* sp.).

A species of this fungus has been recorded on the cotton plant from South Carolina, India, and Australia. In New South Wales it has been found associated with spotting of the leaves and bolls (see Figs. 10 and 11.) Mr. W. L. Waterhouse, University of Sydney, produced leaf-lesions on inoculations with a species of *Alternaria*, isolated from cotton plants grown in New South Wales. Butler states, "exotic cottons which are being unsuccessfully acclimatised in India are often invaded by a species of *Alternaria.*"

Recognition.—The spots may be pale green, then straw-yellow, of a brittle papery texture, with irregular, concentric ridged zones. It appears to be a weak parasite, and possibly attacks only plants whose vitality has been lowered owing to some unfavourable condition of soil or climate.

Control.—Destruction of diseased trash by burning and rotation of crops appear to be the most practical ways of reducing the fungus.

Some Other Diseases.

Mildew (*Oidium* sp.) on cotton is of rare occurrence in India, but common in the West Indies. The damage caused by it is only slight, as only old leaves are attacked. Yellow or red irregular patches appear on the leaves, which ultimately spread over the whole surface.

Hymenochaete noxia Burk., attacks an extremely wide range of plants throughout the eastern tropics. It has been reported as attacking caravonica cotton.

Phyllosticta malhoffi Bub., causes leaf spots on cotton in Bulgaria.

Phoma roumii Frou., is a species of Phoma which is said to cause a serious cotton disease in Africa.

Root-knot (*Heterodera radicicola* (Greef) Mull.).

Root-knot is a well-known disease on a large number of crops besides cotton, and is widely distributed in New South Wales. The losses which it causes in some cases are as high as 80 per cent.

Recognition.—The plants are stunted but not noticeably deformed above ground, as is often the case with plants suffering from wilt. The leaves and stem take on a peculiar sickly yellowish-green colour. The root is found to be covered with galls (see Fig. 12), which interfere with the free interchange of material between root and stem. Plants affected with root-knot are rendered much more liable to wilt owing to the wounds that are caused by the nematodes responsible for the root-knot forming an easy mode of access to the plant for the wilt fungus. Root-knot is essentially a disease of light soils, though it may occur on heavier soils than wilt.

Fig. 12.—Root-knot on Squash Plant.

Cause.—Tiny eelworms or nematodes (*Heterodera radicicola*) are responsible for root-knot. They bore into the roots from the soil and live there, causing minute swellings on the roots. On examination microscopically each of these swellings is seen to contain numerous individuals. The male worms are too small to be seen with the naked eye. The female worms when full of eggs assume a spherical shape and may often be distinguished. Each female may lay several hundred eggs.

Control.—Measures for the control of root-knot include the eradication of susceptible weeds and the practice of crop rotation. A two or three year rotation with immune crops is necessary to starve the nematodes out of badly infested land before a susceptible crop, such as cotton, can be successfully grown. Among the immune crops are barley, corn, certain varieties of cowpeas, grasses, millets, oats (winter), peanuts, rye, sorghum, and wheat.

Insect Pests of Cotton in New South Wales.

W. B. GURNEY, F.E.S., Government Entomologist.

COTTON, like other succulent crops, attracts to itself numerous insect pests. Upwards of thirty have already been recorded as attacking cotton in New South Wales, and, although the number is not likely to be greatly increased as the result of further investigation, it doubtless appears sufficiently formidable. Comparison with the array of insects recorded on cotton in the United States, Egypt, India, and South Africa, however, will show the liability to be only normal. Local farmers need not therefore be deterred from the cultivation of cotton on this score, provided they employ proper cultural methods and take certain ordinary precautions presently to be discussed.

The object of these articles is to summarise the information at present available concerning insects detrimental to the local cotton crop, and to indicate the control measures which have been found effective, or which may be expected to prove effective in view of their success elsewhere. In the compilation of the matter the writer has profited not only from personal observations made in the field, but also from the observations of others and from reports gathered from other States. It is proposed to deal with the pests in the sequence of their attack—first with the pests of seedling plants, next with those of the stems and leaves, and finally with those which damage the blossoms, squares and bolls.

It has been remarked that the cotton plant is very attractive to insects, but some of these pests are attracted from other field crops, and many come from weeds growing among or in the neighbourhood of the cotton. Weeds must therefore be kept under strict control. They are a fertile source of such pests as aphis, red spider, cutworm, &c.

Suggestions for Control before Planting.

Winter ploughing is an important factor in the prevention of infestation, the soil concealing many enemies of the crop to be planted. Many cutworms winter over as pupæ in the soil. Ploughing exposes many of these pupæ to cold and rain and to birds, and white grubs in the soil are similarly exposed to birds, and their numbers thus reduced. Experience has also shown that it is advisable for the farmer to push the growth of his cotton as rapidly as possible. Early planting is therefore advisable—as early as is consistent, that is, with a due regard to the period of late frosts. Early ploughing and repeated cultivation are valuable means of control of many of the pests which otherwise gain a foothold and increase rapidly. Weed destruction in particular should continue throughout the season.

It will be evident from the foregoing that the cheapest and surest methods of reducing pests to a minimum are preventive ones, embracing autumn and

later ploughing, frequent and persistent cultivation, and stubble and weed destruction on the headlands, as well as in the cultivation plots. The seasonal procedure may be summarised somewhat as follows:—

Autumn—

After final picking, destroy the plants by ploughing out and burying.

Winter—

1. Clean up and plough in any rubbish. Ploughing exposes hibernating insects to frosts, rain, and birds.
2. Cut and burn or turn under in early spring all weeds and grasses on the plots and headlands, as this growth harbours plant bugs, aphides, cutworms, &c.

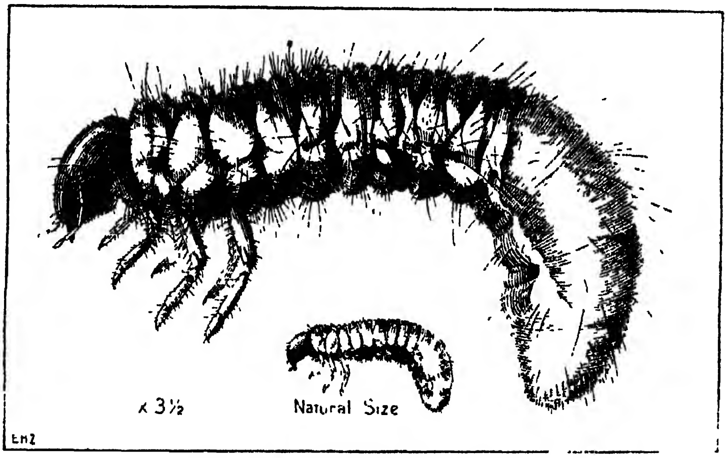

Fig. 1.—Larva of White Grub Beetle.

Spring—

1. Plant early after frosts
2. Avoid where possible planting cotton after maize.
3. If cutworms or grasshoppers show up, use poisoned baits.

Summer—

1. If bollworms or leaf beetles appear, dust with calcium arsenate or lead arsenate powder.
2. Continue cultivation and weed destruction.

Pests of Seedling Cotton.

Among the pests damage by which may be expected early are wireworms. These are long narrow yellowish-white grubs, which hide in the soil and sometimes attack the roots of the seedlings. White grubs (see Fig. 1), the larvæ of certain lamellicorn beetles, may also be harboured by the soil, attacking the roots of the seedlings, and, if numerous, so damaging the crop as to necessitate re-sowing. Another insect which makes an early appearance and which can seriously damage seedling cotton is the aphis; this is often more harmful to the seedlings than to the well-grown plants, though curling of the leaves and weakening of the growth of the older plants occurs when the pest is present in numbers.

Cotton Aphis.

As already stated, both seedlings and well-grown plants are liable to attack by aphis. One species which attacks cotton is *Aphis gossypii* (see Fig. 2). The effect of the infestation is not generally serious except where the ground is not cultivated and the crop is backward or suffering from drought conditions

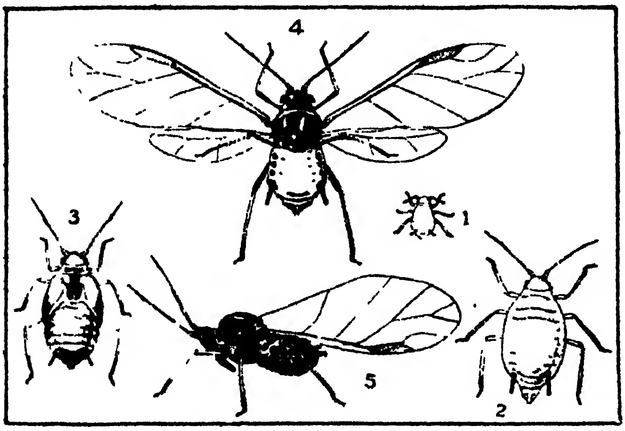

Fig. 2.—Cotton Aphis (*Aphis gossypii*).
1. Young nymph, just hatched. 2. Wingless female. 3. Last nymph stage. 4. Winged female. 5. Dark female, side view. (Highly magnified.)
[After Chittenden.]

Damage.—Aphides suck the juice of the plants, so that their presence in large numbers has a weakening effect and the leaves curl and even turn brown; it is the seedlings, however, that suffer most. A sooty mould (fumagine) sometimes appears on the exudations (popularly known as "honey-dew") of the aphides, and this interferes still further with the growth of the plants.

Control.—As a rule, winter ploughing, continued weed destruction and cultivation prevent the appearance of the aphides. Natural checks such as Syrphid fly larvæ and ladybird beetles also aid in checking their occurrence. Spraying with nicotine sulphate or tobacco washes would pay as a last resort for serious infestations.

Cutworms.

Probably the most serious damage to seedlings is that caused by cutworms of various species. The larvæ of noctuid moths, these pests hide in the soil by day, emerging at dusk to feed through the night on the seedlings. It is their habit of eating through the stems that has earned for them the name "cutworm," and where they are present in large numbers the damage caused may necessitate re-sowing. A description is given later of the common black or greasy cutworm *Agrotis ypsilon*, but other species which may appear are the Bugong moth cutworm (*Euxoa infusa*), and the cutworm larvæ of *Agrotis radians* and *Prodenia litura*. Another species described later is a cutworm type which remains on the plant both day and night and besides eating the foliage and flowers, bores into the bolls when they appear. This species is known as the bollworm *Heliothis* (*chloridea*) *obsoleta*. Control measures for all these species of cutworms are described on the following pages.

The Black or Greasy Cutworm (*Agrotis ypsilon*, Rottn.).

This common cutworm (see Fig. 5) appears in spring and summer. It is widespread in Australia, and is also found in Asia, Africa, Java, New Zealand, Hawaii, America and Europe. It attacks vegetable and garden plants, and maize and other crops, as well as cotton, doing most damage to seedlings and young plants up to a foot high.

Fig. 3.—A "Cutworm" Caterpillar (*Agrotis radians*).

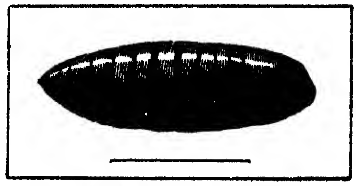

Fig. 4.—Pupa of "Cutworm." (*Agrotis radians*.)

Life History.—The female moth lays her eggs on the leaves or stems near the ground; these eggs are deposited singly or in small batches, and one female may deposit two or three hundred eggs. It is the caterpillars (cutworms) which hatch from these eggs that do all the damage. They feed voraciously and grow rapidly, and moult five times during their development at intervals of two to six days. They are of a dull or greasy smoky-black colour, somewhat paler on the under-surface. When full-grown

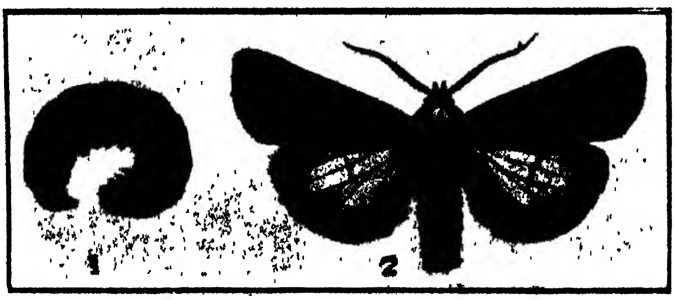

Fig. 5.—Another Cutworm (*Agrotis ypsilon*).
1. The Caterpillar (Cutworm). 2. The moth.

the cutworm measures $1\frac{3}{4}$ inches in length, and it then buries itself to a depth of from 2 to 3 inches in the soil and changes to a dark-brown pupa or chrysalis. Ten to twenty days later the adult moth emerges from the pupal shell and pushes its way to the surface.

The body and front wings of the moth are of a rich dark-brown colour; the hind wings are much paler and of a smoky brown. On the front wing there is a broad pale-brown patch towards the tip and also a characteristic black streak, which streak is crossed by a crescent-shaped mark (see figure).

The egg is minute (only about half a millimeter in diameter), creamy-white and circular, with dome-like contour above. Under magnification it shows ridges running from the crown to the base.

Control.—For the control of this and other cutworms, the use of bran and paris green baits has proved most effective when seedlings and young plants are attacked. The bait is made by mixing 1 lb. of paris green with 24 lb. of bran while dry, and then adding 4 quarts of water in which 4 oz. of salt has been dissolved; in lieu of salt, 6 oz. of treacle may be used. In America and South Africa three or four oranges are chopped up and added to the water, and this ingredient is reported to make the bait much more attractive to the cutworms. The bait when mixed should be a slightly damp crumbly mash; too much water makes it lumpy, and difficult to spread. With this bait in a sack slung over the shoulder or across horseback, a man can walk up and down the rows scattering handsful lightly at the base of the seedlings. It is best scattered late in the afternoon.

The use of these poisoned baits has proved very effective. Where swarms of cutworms, such as the army worm, are noticed advancing on the crop, the grass or weeds in front of them may be sprayed with arsenate of lead or paris green spray with a view to poisoning them before they reach the cotton. Another method is to plough a deep furrow in front of the advancing caterpillars with the steep side of the furrow toward the crop to be protected. The advancing caterpillars accumulate in hundreds in this furrow and may be sprayed with oil or crushed by a log drawn along the furrow.

The adjacent weeds and grass should be watched, and at the first appearance of cutworms sprayed with arsenate of lead or paris green before they can turn their attention to the cotton.

A Cotton Cutworm Moth (*Prodenia litura*, Fabr.).

This is a pest that is reported to do serious damage sometimes in Egypt; it also attacks cotton in South Africa and India. It has a wide range over Australia, and may be expected to attack the cotton crop here. Other food-plants are castor oil, tobacco, tomatoes, jute, lucerne, maize, peas, cabbages, grasses, &c.

Life history.—The eggs are laid in masses on the surfaces of the leaves, and several hundred eggs may be laid in batches by a single female. These eggs hatch in two to five days, and after moulting five times, the fully-grown caterpillar burrows into the soil to pupate. The caterpillars sometimes attack seedlings of castor oil and maize, and then behave like cutworms and hide in the soil by day and feed at night. The pupal stage occupies ten to fourteen days, but the last brood over-winters as pupæ in the soil. Upwards of five or more generations probably occur in our northern districts.

Damage.—In Egypt the leaves are attacked, and the flowers and young bolls may also be damaged. It is to be expected that they will sometimes damage the seedlings.

Control.—Handpicking of egg masses, though useful, can only be resorted to in those cotton-growing countries where labour is cheap. Dusting with arsenates may have to be resorted to if the infestation is very serious. Preventive measures are winter ploughing and destruction of weeds which may harbour the pest during the spring.

The Red Spider (*Tetranychus bimaculatus*, Harvey).

The common red spider is widely distributed throughout the world; it occurs in the United States, in Europe, South Africa, Hawaii, and Australia. It has a wide range of food-plants, including beans, peas, and a long list of garden plants and weeds. In the United States 183 species of wild and cultivated plants have been recorded as hosts of this pest.

The very minute round eggs are at first white, but gradually change to a dark red as the development of the young spider within the transparent egg shell proceeds. The adult female spider is extremely variable in colour; it is generally rusty or brick-red, but it may be rusty green or yellowish, or it may be almost black. When full grown it is still very small. The adult male spider is almost always a rusty salmon in colour. The adult mites and some of the eggs over-winter and rapid development commences in the spring.

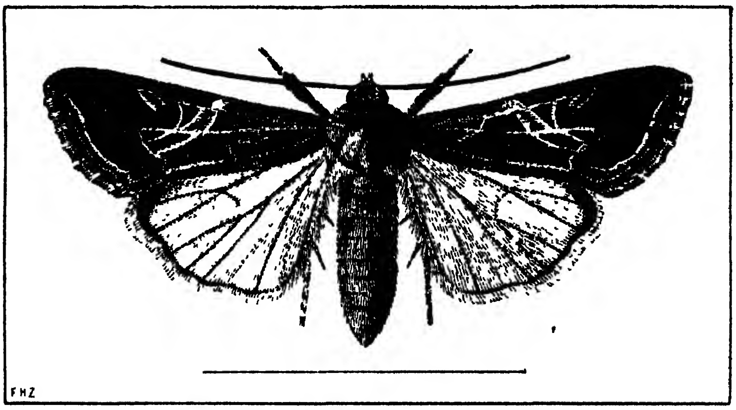

Fig. 6. –A "Cutworm" Moth (*Prodenia litura*).
The adult stage of a Cutworm.

Life History.—The eggs are deposited on the under surface of the leaves of a great variety of plants. The eggs hatch in a few days, varying with the temperature from three or four days in summer to one to three months in winter. The six-legged larvæ which emerge at once begin to feed by inserting the sharp proboscis into the tissue of the leaf. In two days' time the larva moults and reaches the first nymphal stage. In another two days a second moulting takes place, and in less than two days after this the mite is adult. Thus some nine days only is required from the laying of the egg to the adult mite stage. The females pass through two nymphal stages before becoming adult, the males through only a single nymphal stage.

In the summer the female requires about ten or eleven days for the completion of a generation, while the male requires about nine or ten days. There are about sixteen or seventeen generations in the course of a year. The number of eggs laid by a single female varies from 75 to 100; the eggs are usually deposited in from ten to twelve days at the rate of eight to fourteen a day.

Damage.—The under surface of the leaves of both seedlings and well-grown plants is attacked, the epidermis being pierced and the juices sucked out. A severe infestation causes the leaves to turn yellow and brown, and eventually the leaves and bolls may be shed. The defoliated plants rarely

produce much cotton, though in some cases they may re-develop foliage and be restored to almost normal appearances. In most cotton areas, however, red spider is only regarded as a minor pest, though following on dry conditions here on cotton it may increase seriously and do damage.

Control.—Clean cultivation, or the extermination of weeds and plants which harbour the pest, is the most important preventive measure. The pulling up and destroying of the first few plants showing infestation often prevents a serious outbreak; the grower must keep a strict watch on sus-

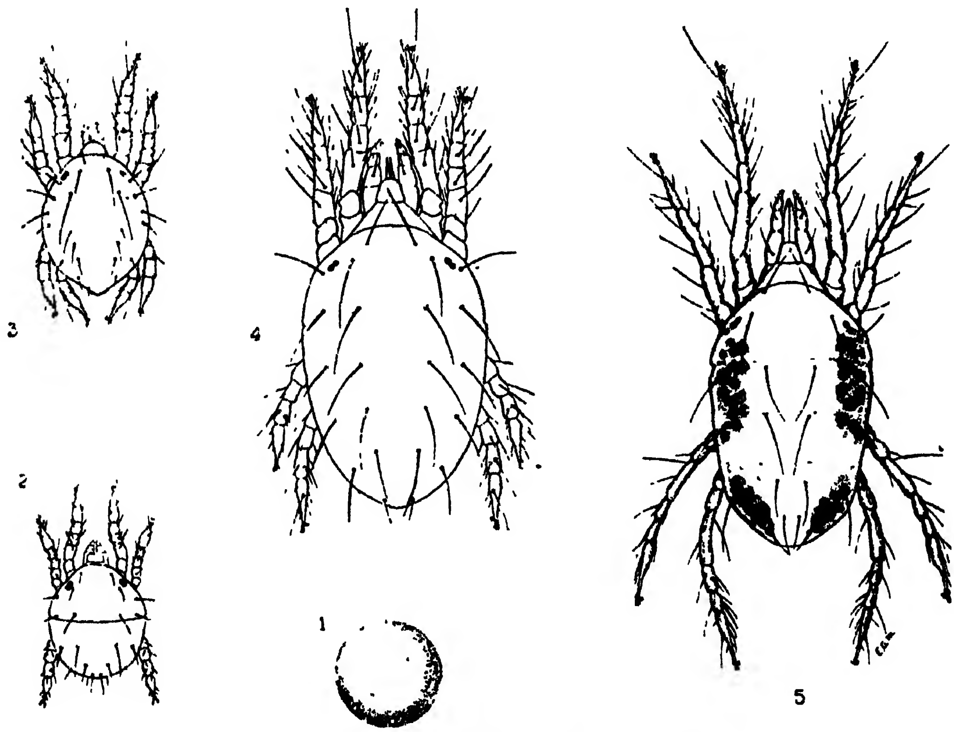

Fig. 7—The Red Spider (*Tetranychus bimaculatus*).

1. The egg. 2. The newly-hatched larva. 3. The recently-moulted protonymph. 4. The mature deutonymph just prior to the final moult. 5. The adult female. (Highly magnified.)

[From Bulletin 416, U.S. Dept. of Agric.

pected fields so that the earliest affected stalks may be detected. Frequent cultivation retards the progress of the migrating mites and discourages the spread of infestation. It has been found that the spiders are unable to liberate themselves when buried 1 inch or more in the soil, so that the ploughing between infested areas possibly deters the spread of the mite. Several contact sprays have been found to give good results. Spraying must be done very carefully so as to reach all possible hiding places. Sprays which may be used are:—(1) Potassium sulphide (1 oz. to 2 gallons of water). (2) Lime-sulphur (home-made or commercial). (3) Kerosene emulsion. Any of these sprays is effective, but a second spraying after an interval of a week is advisable to destroy mites that were in the egg stage at the time of the first spraying.

(*To be continued.*)

The Production of Comb Honey.

W. A. GOODACRE, Senior Apiary Instructor.

WHILE a large number of New South Wales apiarists go in for the production of comb honey on a limited scale, very few have attempted to specialise in the line. In the United States there are quite a large number of commercial producers of comb honey, and excellent returns are frequently obtained.

Comb honey in section boxes, nicely built out and properly cared for, is much sought after by consumers, and is usually easy to dispose of; in this connection one has only to observe the notice which the commodity attracts at the Sydney Royal Agricultural Show and the sales made. Where local markets for honey are available, no trouble should be found in disposing of a large number of sections. Why, then, since local sales are fairly sure, do not a larger number of bee-farmers endeavour to make more of a feature of the business ? The answer is probably because comb honey is more difficult to produce, and the management of the bees during production is more troublesome. It is a business which, if carried out on a commercial scale, calls for particular care and study. There are many districts, however, where the production of comb honey could be carried out in a commercial way, and combined, if so desired, with that of extracted honey. Where the honey flow is light or slow conditions cannot be regarded as favourable. Fairly heavy flows are necessary, so that the bees may build out the comb quickly and fully. Moreover, where a good flow obtains the trouble from swarming will be lessened.

The apiarist who intends going in for the production of comb honey must first give careful attention to the preparation of material and of his colonies. For a good start, say, next year, he should do a little at the business this season, producing what are known as bait sections for distribution among the supers next season to induce the bees to commence readily.

Preparation of Material.

Section boxes for use in the half-storey or Bolton (Ideal) hive are available at the factory, and it would be advisable for the beginner to purchase a super fitted up with sections as a guide to correct adjustment. As there are no lugs on the section holders to support them in the supers, a strip of tin about half an inch wide is tacked across the bottom of the end boards of the super body; the section holders are placed in position and supported by the tin strips and the section boxes fitted neatly along them, and on each side of the row of sections is placed a wooden separator (see Fig. 1). The separators keep the rows of sections sufficiently apart for the convenience of the bees, and act as a guide in getting the comb built straight. The springs (Fig. 2) are

placed behind the outside separator to keep the sections firmly together, and wedges are fitted at each end for a similar purpose. There are two types of section boxes manufactured; one allows for a beeway in the frame, and the other is a plain one. In fulfilling their orders, factories supply separators

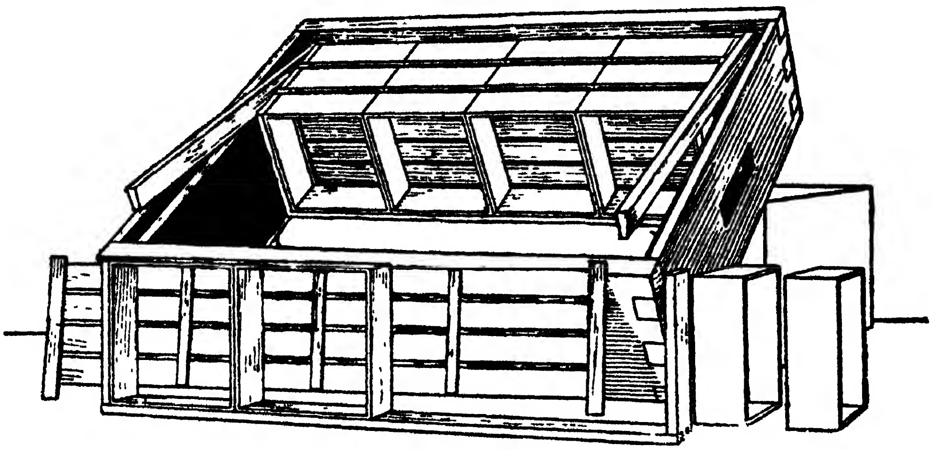

Fig. 1.—Showing the method of adjusting the section holders, separators, wedges, &c.
[From F.B., No. 1039, U.S.A. Dept. of Agric.

to suit the class of section box asked for. Bulk supplies of sections are not folded or clasped when received from the factory, and to minimise breakage when folding at the apiary it is advisable to lay the sections out and run a thin stream of hot water along the grooves only. Usually the manner of packing allows convenience for this damping work.

Fig. 2.—Super spring.

Placing Comb Foundation in Section Boxes.

Comb foundation (thin surplus) is fastened to the top of each section inside about the centre. It is cut to fit easily in the box, and a ¼-inch space is allowed at the bottom to allow for stretching. Some apiarists use only narrow strips of foundation; others place a long piece about full width from the top and a very narrow strip from the bottom, making the necessary allowance of a quarter of an inch between the strips for stretching. The additional strip of foundation at the bottom ensures firm attachment of the comb by the bees, and where much handling or transport is to be considered it is a necessity.

Various methods are used in fastening comb foundation in the section boxes, and many useful devices are obtainable. In a number of cases a heated metal plate is used to melt the edge of the foundation and firmly attach it to the section; in others the foundation is fastened by squeezing

the edge on to the wood of the section, while yet another method is to run melted wax along the edge while the foundation is held in position. A simple tool to fasten the foundation can be made from a piece of solid tinned steel, cut to fit easily in the section box and fitted with a handle. The implement is kept heated during the work of fastening.

(*To be continued.*)

December Work in the Apiary.

Any effort which will save his bees discomfort or an unnecessary expenditure of energy is well worth the while of the bee-keeper, for it means a corresponding lengthening of the bees' period of service. During the hot weather a good deal can be done in this direction. It is important, for instance, to have a good supply of fresh water handy to the apiary. Many apiarists depend for supplies on creeks near the hives, and during dry times the water becomes scarce, compelling the bees to take long flights, and thus to waste a considerable amount of energy. Artificial supplies situated near the apiary are an advantage, and well worth the trouble of establishment. Again, shade at the entrance of the hives means greater comfort for the bees during the hot weather, and an appreciable saving in vitality.

Extracting operations will be carried out in a number of localities during this month; in other parts droughty conditions are obtaining, and the bees are having rather a bad time. During adverse times the colonies should be kept comfortable and compact and have supplies available. The feeding of small quantities of sugar syrup at regular intervals, and, if pollen is scarce, of a substitute such as rye or pea-meal, should be given a trial. Conditions may improve later on and the benefit of assistance given now will then be appreciated. Where there is no prospect of better conditions the removal of the apiary to a better locality for the season should be considered.—W. A. Goodacre, Senior Apiary Instructor.

Farm Work for College Students.

The Minister for Agriculture (Captain Chaffey) is desirous of securing positions in farm work for Hawkesbury College students. Two classes of lads are available viz., those who are now completing their three years' Diploma Course and desire to take up farm work for their living, and those who desire to utilise profitably the College vacation, which extends from 17th December to 26th January. These lads range from 17 to 23 years of age, and as at the College they have had the benefit of a sound theoretical and practical training, they should be able to give a good account of themselves at practically any class of farm work. Captain Chaffey would be glad if any farmer, who desires to secure the services of any of these students, would communicate direct with the Principal of the Hawkesbury Agricultural College, Richmond, furnishing particulars of the positions available and the wages offered.

Some Notes on Fumigation of Citrus Trees.

W. J. ALLEN.

OLD citrus growers will remember the trouble given by red scale before the introduction of fumigation by the Department of Agriculture over twenty years ago. The first experiments were carried out by the writer in 1899 in the Galston and Kurrajong districts, and at Hawkesbury Agricultural College. Many growers were sceptical of the treatment at first, but owing to the successful results of these and later experiments and demonstrations, fumigation gradually came into fairly general use. With the introduction of miscible oils and the rise in the cost of tents and fumigation material, the method was dropped by many, who, however, found spraying did not give an entirely satisfactory control. It is gratifying to know that since the cost of outfits and material has dropped fumigation is again being gradually adopted.

Liquid hydrocyanic acid cannot be transported by either rail or water, and two years ago the Department made inquiries as to the possibility of it being manufactured locally (see *Agricultural Gazette*, November, 1921, page 827), and found no encouragement. Seemingly, therefore, there is very little hope for its use for fumigating fruit trees in New South Wales at present.

Professor H. J. Quayle has been investigating fumigation with calcium cyanide, the first work with which was carried out in California last year with very promising results. Tests were conducted on the Murrumbidgee Irrigation Areas, beginning on the night of 27th March last, and were continued for three weeks, 200 trees being treated in six different orchards. Professor Quayle has now submitted his report to the Water Conservation and Irrigation Commission, and from it the following is extracted:—

"Calcium cyanide in the form of a very fine powder was used by simply being blown under the tent by a special dust-blowing machine. The results on all these test blocks were entirely satisfactory. There was a complete kill of the scale with full dosage, and no injury was done to the trees.

"The advantages of this new system involving the use of powdered calcium cyanide are its simplicity, its much less cost, and the fact that there is no acid to burn the tents and consequently shorten the life of the most expensive part of the fumigation equipment.

"The comparative cost of the old and the new systems may be shown for an average sized tree in this area requiring about 6 oz. cyanide, the same amounts of calcium and potassium cyanide being required for a particular tree.

Old System.

Potassium cyanide at 1s. 7d. per lb—6 oz.	7d.
Sulphuric acid at 7s. 6d. per gal.—6 fl. oz.	3d.
Total	10d.

New System.

Calcium cyanide, at 8d. per lb.—6 oz.	3d.
Total	3d.

"Therefore the cost of materials under the old system is three times that under the new.

"The new system is more restricted to proper weather conditions than the old and the limiting factor is moisture. However, during the most suitable months for fumigation in Australia, *i.e.*, January, February, March, the weather conditions should be satisfactory in this area" (Murrumbidgee Irrigation Areas).

The results of the first tests were so encouraging that further tests were carried out till 7th May, when work was stopped owing to rain, which continued intermittently till the middle of June. The lemon trees treated just before the rain were more or less injured, while some of the orange trees only suffered a slight leaf-drop.

Professor Quayle concludes his report with the opinion that "the only treatment that is at all satisfactory for red scale on citrus trees from my experience is fumigation with hydrocyanic acid gas, regardless of the particular source from which that gas comes."

It may be mentioned that the tents used for ordinary fumigation were used for the calcium cyanide tests, but the flap was not banked down with soil as in the old system. The ground about the trees should be clear of weeds, so that the flap can lie close on the ground. The blower is provided with a hopper into which the measured dose of calcium cyanide is placed and then blown under the tent. The work is carried on at night, as in the old system of fumigation, and the tent is left over the tree for the same period. If the trees get wet before the foliage is clear of the calcium cyanide more or less defoliation is likely to occur. If this injury is likely to be severe there is an element of risk even in inland districts with normally dry summers, as thunderstorms are likely to occur without warning. In the coastal areas not only are dry spells less certain, but there would also be night dews to be contended with.

The Department is arranging for tests with calcium cyanide to be carried out in the coastal districts, in order to ascertain whether it can be used there as well as in inland parts. Calcium cyanide is quoted on the local market at £6 10s. per 100-lb. keg, f.o.r., Sydney, and at £1 15s. per 25-lb. keg.

Whether it will be injurious to the canvas of the tent cannot be definitely stated until it has been used for some time.

The Bracing of Fruit Trees.

J. M. ARTHUR, Orchardist, Hawkesbury Agricultural College.

It often happens that the limbs of fruit-trees extend in length too fast for their strength, and that as a consequence they are unable to support unaided the fruit they are carrying. Though this can to some extent be forseen and provided for at the time of pruning, it becomes more apparent as the fruit swells after setting. The weakest branches first show signs of strain, and should be attended to before any breakages take place; later, as the load increases in weight, more branches may need assistance.

Probably from the earliest days of fruit-growing props have been used to assist trees to carry heavy loads of fruit, and in cases where these are easily obtained from nearby bush, they may be the cheapest form of support Even where the cost of the time for cutting, carting in, and later clearing away makes props the dearer method, a grower may be better able to spare his own time than to find the cash to purchase the material for other methods.

The faults of the prop are that it is often difficult to give the support high enough, and the limb may snap at or above the point of support, and that the props are liable to get out of position and fail in windy weather, and may be in the way of subsequent cultivation.

If props are relied on the number should not be spared: in some cases two at one point on the branch, splayed out from one another, are necessary to provide against overbalancing during wind. Sometimes support should be given at more than one point along the same limb, and readjustment of the props from time to time often becomes necessary. A stouter prop is sometimes used to prevent the shifting by wind; it is bored at one end and fastened to the branch by means of lashing or a stout wire.

To avoid the inconvenience of props, Mr. W. J. Allen, Fruit Expert, introduced a system of bracing by means of lashing at Wagga Experiment Farm orchard in 1897. This method was used for many years, but, though it proved preferable to props, it had defects. The lashing often required renewing after one season, and despite that its position was shifted each year, it would sometimes cut into the limb. The latter trouble can be avoided by placing a piece of hollow scotia with the hollow to the under side of the limb, so that the pull of the lashing will bear on it, the arris of the angle of the scotia being well chamfered away to prevent chafing of the lashing. But such means are cumbersome, and add to the time of adjusting.

In 1910, while orchardist at Yanco Experiment Farm orchard, the writer introduced the method of bracing individual limbs of fruit-trees, an iron screw hook (of fairly strong gauge for large limbs and a lighter gauge for small ones) being used with wires. It has been found that the utmost

discretion is necessary in selecting the point on the limbs at which the hook is to be inserted. If put too low down, the limb invariably breaks just above the hook, and to obviate this the hook must be inserted as high as possible and the limb pruned fairly heavily above.

In instances where two weak limbs are opposite to each other and both require bracing, it is not always practicable to brace the two with the single wire across, as one or both may be pulled out of position and crowd other limbs in the vicinity. This difficulty can be overcome by attaching two wires to a hook inserted in each weak limb, and taking the wires out at an angle from each other and securing them near the bases of stronger limbs to either side of the tree. The one set of screw hooks on the stronger limbs could generally be used for the wires from both of the weak ones. Again, in the case where a limb on one side is weak and the one opposite is not over-strong but does not require bracing, the hook should be inserted at the usual height on the weak limb, but lower down on the stronger one, so as not to bring the limb used as an anchor out of position, and to give a greater leverage for the weak one. Brass hooks are not a success, as with much weight they generally straighten out.

At Yanco the wire used was about No. 14. The central ring described in some American publications was not used, but in many instances the securing of the bracing wires at their crossing point was tried, and it was found that not only was the system a hindrance in spraying, but also that, the pull on all the limbs not being equal, the majority of the weaker limbs were pulled out of their position by the stronger ones. This method was discarded in favour of bracing two, or in some instances more limbs individually. Up to the time of my transfer from Yanco in the year 1922, most of the hooks and wires that were attached in the first instance were still in their original position, and notwithstanding the fact that regular and heavy crops of peaches had been produced annually, seldom had a leader collapsed. For the past eight years the Elberta variety has produced over 8 tons per acre annually at Yanco Experiment Farm.

In the Interests of Australian Forestry.

"To link together societies and individuals interested in forestry, agriculture, &c., or the study of nature in any of its forms; to assist in creating a 'Forest consciousness,' thereby educating the public to a realisation of the value of forests and to the necessity for their protection and extension; generally to work in the interests of 'the tree,' and specially, through the schools branch, to educate young people on these lines."

In the foregoing terms are set down the purposes of the projected Australian Forest League, which will no doubt have the sympathy of many far-sighted Australians.

The half-crown subscription (two guineas for societies), which signifies practical support, may be sent to the Hon. Secretary, Mr. F. T. Berman, Public School, Five Dock.

Orchard Notes.

DECEMBER.

W. J. ALLEN and W. LE GAY BRERETON.

SHOWERS of rain of a serviceable nature have been all too scarce in many districts this spring, and cultivation can be carried on with the cultivator, but if in more fortunate localities showers have occurred at such frequent intervals as to hamper cultivation and the weeds have consequently grown too large to be dealt with by the ordinary cultivator, or if the soil has become compacted from the trampling due to spraying operations, then the plough will be necessary to put the soil into condition again. The present month (December) is a good time to get this ploughing through in the later pome and stone fruit orchards, as, not only is the bulk of the spraying through, but the fruit will presently have grown large enough to weigh the branches down and prevent cultivating implements from getting reasonably close to the butts of the trees.

In some of the light soils the latest forms of one-way disc cultivators, which are operated in a similar manner to a plough, will perform this work admirably.

Pests and Diseases.

The second cover spray for codlin moth (which is the third application of lead arsenate if a single calyx application has been made, or the fourth if the double calyx application has been employed) will be due towards the end of this month. A spreader can be used with this spray as described in last month's notes.

Growers who are despatching fruit at the present time should be careful that they do not introduce fresh codlin moth or other fruit-destroying insects to their orchards in returned cases. Even if they are packing only absolutely clean fruit, it is no guarantee that the cases may not come back infected. Quite a number of larvæ of codlin moth have been found in their cocoons in returned boxes that had been despatched packed with nothing but grapes. Dipping for three minutes or so in boiling water directly the cases come back to the packing shed (or before if possible) is the safest way of disinfecting returned cases. Mere inspection and squashing what grubs are seen is not thorough enough treatment, as many grubs push their way under loose points and into cracks where they are missed unless dipped.

It is often said that dipping of returned cases is too costly, but when one considers the expense involved in spraying for the suppression of pests it seems absurd to introduce them into the orchard.

Cases are also often returned with old wrappers and wood wool in them, and it is not an uncommon sight to see them lying about the station yards even when orchards are quite close, or, worse still, thrown out right at the

orchard. Such practices amount almost to criminal negligence, because no one can claim that the expense of burning such rubbish immediately is too costly.

A watch should be kept for the cherry tree slug on cherry or pear trees, nd if it appears the trees should be at once sprayed with lead arsenate. Where the fruit is just about ready to pick when the slug appears, then the spraying should be delayed until immediately after the trees are cleared of fruit. If this pest is allowed to destroy the foliage it is liable to affect the cropping for the following season.

Summer Training.

When this subject was mentioned last month one form was omitted.

Young trees sometimes make such rapid growth that there is danger of the new shoots being blown out or seriously put out of position, and it is then necessary to check them back during the early summer. They will generally make a second growth, and by going over the trees a few weeks later the most desirable of these shoots may be chosen for carrying on the extension of the leaders, and the others can be checked. If this is done early in the season the growth ripens off sufficiently to be made use of as leaders during pruning in the winter. This work applies more to trees grown under irrigation, and, like the summer training described last month, must be done only with discretion and when necessary.

As they develop or extend their wall of foliage orange trees smother some of the inside growth, and such inside growth should be removed. This work can be carried out any convenient time during the summer.

It is the later apricots generally that are suitable for drying. They should be perfectly ripe and are generally ready at the end of this month and early in January.

Farmers' Bulletin, No. 52, containing information regarding the drying of fruits, may be obtained on application to the Department, price 10d. post free.

Labour Required by Farmers.

With a view to ascertaining more definitely what additional labour is likely to be required in the rural districts of New South Wales, the Government has asked the New Settlers' League to instruct its branches to cause a census to be taken in the different centres. Farmers and other employers of labour are asked to indicate their prospective additional requirements during the coming year, and it is hoped that arrangements will then be possible for settling in the same district female domestic servants, adult farm hands, and boys for farm work from one centre in Great Britain. The successful launching of such a group system of settlement is likely to produce entirely satisfactory results. Prospective migrants will be more ready to come, and will settle down more contentedly, thereby giving greater satisfaction to the employers. The Government hopes that farmers and others will support the scheme and place themselves in touch with the local branch of the New Settlers' League.

Bee-farming Locality.

W. A. GOODACRE, Senior Apiary Instructor.

A KNOWLEDGE of locality is of vital importance to the bee farmer. Many of our prominent authorities on bee culture say, "Know your locality if you wish to be successful."

A man should not be satisfied with gaining a knowledge of one particular locality, but should make a good general study of the subject, extending the scope of his knowledge as far as possible, so that he would be in a position to select a site in a new locality and have a fair assurance of successful operations. The idea is rather too prevalent, especially amongst beginners, that a locality should be selected by taking into consideration only the variety of valuable honey flora which is growing there. Often it is found out later, when the apairy has been established, that certain of the species flower too late or too early in the season to be of any value.

Apart from the consideration which should be given with regard to the variety of species of special honey flora, in making a selection of a locality for a permanent stand, prominence must also be given to the flowering periods of the trees, &c. Variation in climatic conditions has some effect on the flowering period, and within a 20-mile radius we find on lower lands, where the climate is warmer, certain autumn honey flora will flower early enough to allow the bees to gather surplus stores, whereas on higher land not far distant the same species flower too late to be of value. In places on higher land, where the flowering periods are favourable, and advantage is at times gained by removing the bees to the lower and warmer parts during spring to catch an early flow and to put the bees in the right spirit to make the best of conditions when they are returned to the original stand.

In view of these facts it should be evident that a study of the flowering periods is essential, along with a knowledge of the value of the honey flora.

There are many promising localities in this State which are at present inaccessible, but with the further extension of roads and railways they will no doubt become available. So far as locality is concerned, we appear to be in a good position for future extension of the industry. We should endeavour to prevent destruction of good bee-farming localities by inducing the authorities to prevent indiscriminate ringbarking of trees where possible. We should bring under the notice of agriculturists the value of growing crops such as Hubam clover, White Sweet clover, lucerne, &c., so that localities will be improved. Valuable honey flora, such as the crops mentioned, is grown extensively in the United States, and agriculturists there recognise its value. Lucerne is well known here, but there is not much doing amongst the clover species so far.

Vineyard Notes for December.

This spring has proved particularly bad for cutworm trouble; it has not been confined to one particular locality, but has been prevalent throughout the vine-growing districts of the State. In some parts I have noticed that young vines, even up to their second year, have been absolutely stripped of their foliage, the canes being affected to such a point that a heavy blow would break them off. In a season such as this it behoves the grower to resort to the spray on the first signs of cutworms. Arsenate of lead can be mixed satisfactorily with Bordeaux, thereby saving a second operation. Where the pest appears to be making rapid headway it is highly advisable to resort to both baiting and spraying.

The weather conditions having been more or less dry of late, vine-growers have in some cases become lax in their spraying with Bordeaux for downy mildew; this applies particularly to the northern districts. Although it is possible that growers may go through the season without being troubled with mildew, the profits at stake are certainly greater than the cost of the spray and its application. The season has so far been dry, but one can never foretell when a thunderstorm is likely to occur, and it is then that fungus trouble is apt to make its appearance. The importance of spraying as part of the season's routine, independent of prevailing weather conditions, cannot be over-estimated; and early sprayings, whereby one is able to get more or less into direct contact with the young bunches, are of much greater benefit than sprayings that have been deferred until later in the season, when the canes have grown to such an extent as to make it nearly impossible, with the ordinary spraying outfit, to get the mixture well into the centre of the vine

With the approach of summer conditions one looks forward to seeing the cultivation of the vineyard well advanced, with the ploughings complete and the cultivators at work to bring the soil into reasonable tilth and eradicate the weeds that rob it of moisture. With regard to young vines that have been Yema-budded, those who are experiencing their first season may be offered a word of advice They will find that the stock will periodically throw up young American shoots, and these should be disbudded or rubbed off as they appear. It will also be found that the scion from the Yema bud makes very rapid growth, increasing the leverage and leaf surface, so that strong winds will catch and easily break the shoot off at the union. The scion growth therefore requires to be tied to a stake from time to time as the length of the growth increases—H. L. Manuel, Viticultural Expert.

Improvement in Appearance of Honey Containers.

Some advice has already been given in this journal regarding the disadvantages of endeavouring to dispose of honey in containers where the outside appearance is not attractive. Where the tins have deteriorated much and have become unattractive, it is advisable to discard them. There are, however, a good number of containers which are still quite serviceable, and yet have lost some of their attractive outside appearance. A number of such containers were collected at the Government apiary and given a coat of aluminium paint on the outside, and it effected a remarkable change. After purchase of the paint in the ordinary way the cost was one penny per 60-lb. container. The paint dries almost immediately and does not rub off.—W. A. Goodacre, Senior Apiary Instructor.

Insect Pests of the Present Season.

W. B. GURNEY, F.E.S., Government Entomologist.

NOT for several years, perhaps, have there been so many reports of serious damage being done by insect pests as in the present spring. As the season has advanced there has been a series of infestations by different insects in sufficient numbers to cause considerable losses. Steps have been taken by the Department to bring under the notice of farmers the methods they may adopt for the control of these invaders, but it may be well to draw attention once more to the importance of applying these methods immediately their necessity becomes apparent

Cutworms.

Reports have been received from many parts of the State of the prevalence of the grubs of the various noctuid moths of the genera *Agrotis, Euxoa* and the allied tomato and maize earworm, *Heliothis obsoleta.* They commonly appear in large numbers when a rank growth of grass and weeds follows good spring rains, so that clean cultivation is an effective method of control We have a record this season which is without precedent in that in some cases the "tomato worm" (*Heliothis*) increased enormously among weeds, and later the well-grown caterpillars climbed into adjacent fruit trees and attacked the foliage and ate their way into the fruit. The neglect of cultural work in and around the orchards, and the failure to adopt the poisoning methods suggested by the Department early in the spring, thus resulted in considerable losses. Reports have been received by the Department latterly of cutworms attacking cotton in the Lismore and Singleton districts, and growers of these and other crops are urged not to neglect controls.

Where it becomes apparent that these pests are present in large numbers, it is possible to reduce the infestation very appreciably and to protect the crops by the prompt use of an arsenic poison in the form of a bait. This consists of 1 lb. paris green and 24 lb. bran, mixed dry and then made into a damp crumbly mass by adding about 5 quarts of water in which 4 oz. of salt or else 6 oz of treacle have been previously dissolved. The addition to the water of six oranges or lemons, finely chopped, makes the bait more attractive to the caterpillars. If the paris green or bran are not available, the weeds or grass on which the caterpillars are feeding, or turnip, lucerne or potato tops, may be cut into short lengths in a chaffcutter and then dipped in a mixture of 1 lb. arsenate of lead and 16 gallons of water, and this poisoned material used in place of the bran bait. Yet another method that can be adopted is to spray thoroughly with a mixture of 1 lb. arsenate of lead and 16 gallons of water a strip of the crop about 6 feet wide at the edge of the crop to poison the caterpillars before they move into the crop.

The bait mentioned is very attractive to cutworms and they will take it more readily even than the crop. It should be scattered at dusk so that it shall remain moist and attractive overnight, but it may be applied quite effectively in the daytime if there is urgent need for the protection of the crop. The bait can be put in a sack, which can be thrown over a horse's back, and the poisoned material can then be scattered in front of and among the advancing caterpillars in strips of 6 to 10 feet wide, and at the rate of about 5 lb. to the acre.

The use of this bran bait is quite practicable, it is inexpensive to apply, and on many occasions it has saved valuable crops.

Vegetable Weevil (*Desiantha nociva*).

This pest is a small brown weevil which feeds at night on the plants, hiding in the soil by day; the larva is a small light-green grub with similar habits. Both do serious damage to tomatoes, potatoes, carrots, turnips, and other crops, eating down the plants within a day or two when present in numbers. The damage is more serious to young plants.

The use of arsenate of lead in spray form, of arsenate of lead powder dusted on to the bases of the plants, and of calcium arsenate also as a dust have this season all been proved effective on infested potatoes. In tests with these agents, "kills" of 78, 83 and 97 per cent. were obtained respectively, and in no case was burning of the foliage observed. Failing a dusting machine, a hessian bag will be found quite effective for the application of the powder. However, as many growers possess pumps, the following liquid spray may be more convenient to apply, viz., arsenate of lead powder used at the rate of 9 oz. to 15 gallons of water. If lead arsenate paste is used, 1 lb. should be used to 15 gallons of water. It is important that the nozzle of the spray be inserted at the base of the plants and the spray directed upwards as far as possible, so that the base of the plants and the under surface of the leaves receive a dose of the poison.

Thrips.

The conditions this season have been distinctly favourable to the development of thrips, those minute insects that are found in the blossoms of fruit trees, and, indeed, in nearly all flowers. They only occasionally become numerous enough to do damage, but this season they may be expected to infest particularly the late flowering varieties of apple, pear, and cherry, and in addition may also do considerable damage to such plants as tomatoes by injuring the blossoms and thus preventing the setting of the fruit.

The most common species in New South Wales is the rose thrips (*Thrips tabaci*). Their development from egg to adult stage occupies from sixteen to twenty-one days in the summer. The eggs, which are extremely minute, are deposited on the twigs or flowers, and hatch in four to seven days into fine pale yellowish insects, which grow to adult size in about two weeks.

Feeding is accomplished by tearing the surface tissue of the blossoms and sucking up the juices thus set free. Many generations are possible during our long summer, and the quick development allows of many broods and rapid increase, all stages being found within one flower at the same time.

Preventive measures are of the greatest importance in thrips control. Of these, clean cultivation is most successful, as weeds and grasses are the principal breeding grounds. All such material, therefore, should be turned under early in the spring, especially as the early insects, leaving the weeds on which they have been bred attack the blossoms of the garden or orchard and reduce the setting of fruit. A winter spray of lime-sulphur just before the buds burst in the spring is useful in killing any thrips that are on the buds as soon as they open.

If the blossoms have become infested, however, the safest control is to spray with tobacco wash made from approximately 10 lb. waste tobacco stalks and 30 gallons of water. The best results are obtained by boiling the water and then pouring it over the tobacco, and allowing it to stand for twenty-four hours. Then strain off the liquid, dissolve in it 1 lb. of ordinary soap, and it is ready for use.

It is probable that a kerosene emulsion could be added to the tobacco wash with advantage. The mixture would be made as follows :—Make the tobacco decoction as above, then take about 5 pints of kerosene and an equal quantity of water in which 1 lb. of soap has been dissolved by boiling, and thoroughly mix while hot, forming a primary emulsion. When the kerosene is properly emulsified it forms a thick creamy-white liquid which sets like a jelly when it cools. The primary emulsion is then added to the tobacco decoction and the spray is ready for use.

Proper application of any spray is necessary to success. It is advisable to have a strong pressure to drive the spray into the blossoms, giving them a generous drenching. Sprays are only effective against thrips where they reach and wet the insects themselves. Two or three sprayings may be necessary if the thrips are numerous, in order that the blossoms may be protected up to the time the fruit sets.

For Clean Milk.

Milk as secreted in the udder of a healthy cow is germ-free. Contamination may take place in various ways · first, during the act of expressing the milk from the teat, as the opening from the milk-sinus to the outside is of such a nature that bacteria adhering to the mouth of the milk-duct are washed away with the first milk and therefore contaminate the whole milking. It will thus be seen that careful washing of the cow's udder is the first step in the endeavour to produce a bacterially clean milk.—L. S. Barrell, in the New Zealand *Journal of Agriculture*.

To Fasten Hive Frames for Transport.

Although the adjustment of hives for transport by such methods as the wedging together of the frames is often satisfactory, there are cases where special care has to be taken, and in such circumstances a method devised at the Government apiary may be recommended. In a test involving transport of the bees a distance of over 200 miles by motor and rail, this new method has given very good results. It should be of value to those who consign single-storey colonies long distances, as well as to the careful man in ordinary transport work. The method is simple, but it prevents harmful movement of the frames, in whatever position the hive may be placed.

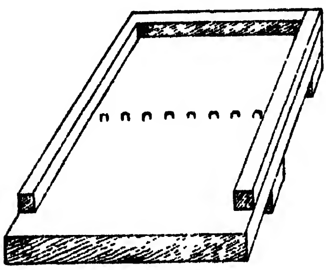

Fig. 1.—The Bottom Board, showing staples in position.

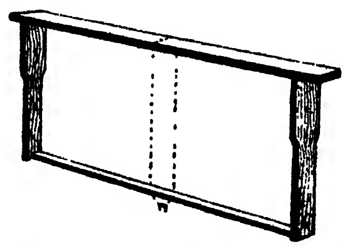

Fig. 2.—Frame with wire in position, passing through staple.

Fig. 3.—The Type of staple used.

The first procedure (see Fig. 1) is to drive frame staples equal distances apart across the centre of the bottom board, using a staple for each frame in the hive, and driving them nearly home, leaving just sufficient opening for a wire to be passed through. The staples should be spaced so that each one will be directly under the centre of the bottom bars of the frames when the latter are placed in the hive body. When adjustment of the frames for transport is being effected, a wire is put through the staple, brought up the sides of the comb, and twitched tightly on the top bar (see Fig. 2). The wire should be reasonably strong—about the guage of the ordinary copper wire which is sold in reels by storekeepers. Each frame is treated separately. If preferred, the wires can first be put through the staples and bent in a convenient position to receive the frames as they are placed in position. A slight movement of the wire before fastening is sufficient to ensure that no bees are accidentally imprisoned.—W. A. Goodacre, Senior Apiary Instructor.

A Warning about Sudan Grass Seed.

Samples of Sudan grass seed have recently been received by the Department of Agriculture which contain seeds of sorghum and a sorghum-Sudan hybrid in addition to certain noxious weed seeds. In view of the risk of poisoning, farmers are warned against grazing stock on any land upon which plants grown from these seeds appear. Further, no seed should be harvested from such areas. Departmental officers are endeavouring, as far as possible, to trace such seed, a quantity of which, it is understood, has been received from another State.

Meantime purchasers are warned as to Sudan grass seed that care should be taken to obtain seed which is free from the impurities mentioned. The Department will examine free of cost any samples of Sudan grass seed forwarded by farmers.

Poultry Notes.

December.

JAMES HADLINGTON, Poultry Expert.

From now onward until April is the season of the year when the aged hens should be disposed of. The skill and judgment with which this work is carried out will have a very material bearing upon the profit or loss account of the farm.

There is observed among poultry-farmers a tendency to carry out this class of work too much by rule of thumb or according to age, and too little by the exercise of skill and judgment in culling out those hens that have ceased to lay. It does not follow that because a hen is two or even three years old she should be marketed right away.

The all important question should be, not "How old is she," but "Is she laying." Every summer there are many thousands of hens marketed in laying condition, the only reason for which is that they are over two years old, and due for disposal as a flock.

The fact that the production from a flock of hens has fallen below a certain average does not constitute a cause for the disposal of the whole flock. It is here that the real business of culling comes in. Every poultry-farmer with experience should know that many two-year-old and even three-year-old hens—or, to put it more correctly, hens in their second and third laying years—will continue to lay right on through the summer, and some even down the autumn months, while others of the same breed and strain will cease to lay about December. The reason for this variation is another story; but the fact should be realised that no wholesale disposal of hens on account of age alone is advisable.

Economic Factors in Culling.

As an example of what is meant in this regard, we might take a flock of, say, 100 hens comprised of two- or three-year-olds, laying about 30 per cent. of eggs. The chances are that less than fifty hens are doing all the laying while the other fifty have ceased. The latter should obviously be disposed of, and the average production of the remaining fifty would be fairly high for the time of the year, and would be returning a good profit over feed. If the poultry-farmer is skilled and diligent in his work, it is practicable so to cull these two- and three-year-old hens that they will show a profit until the last of them is off the farm.

The reason why so many unproductive hens are carried on poultry farms is either a disinclination to go to the trouble of culling them out, or lack of experience or of the confidence necessary to the job. The first is inexcusable; the second shows the necessity of knowing some of the rudiments of successful poultry-farming.

Many poultry-farmers never tire of the endeavour to increase the laying capacity of their hens by breeding, and yet neglect to acquire the skill that gets the maximum production from the birds they have. A good deal of the skill necessary to the best results depends upon the faculty for observation, and, in any case, persons who have not that faculty in a high degree are not likely to succeed as poultry-farmers.

The main point is that, instead of regarding a flock of aged hens as due for disposal at a given time, they should be continually culled out as they go off laying. No farmer can afford to be slack on this point; he should continually watch the incidence of production to keep himself informed of where culling is required. An observant poultry-farmer, even with a limited experience, should be able to distinguish the layers from those that have ceased to lay. If this skill is lacking, the acquirement of it would add more to the profits of the farm than almost any other knowledge that could be gained by the farmer.

Simplicity of Culling.

As indicated above much of the ability necessary to proper culling will depend upon the observation and diligence brought to bear in its performance. There are, of course, some finer points in skilled culling that might be learnt, but the two main evidences of cessation of laying are to be found in the comb and the pelvic bones of the birds. When the experienced eye is run over the birds the shrivelled or dead appearance of the combs of some of the birds is quite sufficient evidence of cessation of laying, while the fresh appearance of others is equal evidence of continuance. Both may be more or less deceptive in some hens, but in such cases confirmation is sought in the pelvic bones situated on either side of the cloaca. If these be closed and rigid no eggs are being laid, but if open and pliable it may be assumed that the hen is in laying condition. There are a few exceptions to the latter rule, but not so many as to constitute any considerable risk of mistakes being made.

Requests have often been made for illustrations depicting the classes of birds that should be culled, but the difficulty that arises in this connection is that no matter what amount of work was put into such illustrations there would be a considerable amount of misinterpretation. This being so, one hesitates to attempt this method of instruction. However, it is hoped that it will be possible at an early date to arrange for a number of practical demonstrations on this subject.

Combating Chicken Pox.

Some little time ago the attention of the Department was invited to what was claimed to have been achieved in the United States of America in the direction of combating chicken-pox by inoculation with a vaccine. The Department was already fully aware of these claims, and was prepared to investigate them when opportunity should present itself. It is expected that some work of this character will be undertaken at the newly established Veterinary Research Station at Glenfield in the coming season,

when the disease may be expected to show itself again—for be it remembered there is a definite season in this State in which this disease makes its appearance, namely, January to May, though it mostly occurs during February, March, and April.

The Department is in possession of literature on the subject of vaccine treatment for chicken-pox, issued by the University of California. In one important respect it is well perhaps to correct an impression entertained by poultrymen in this country. The vaccine is not put forward in the bulletin as a preventive of chicken-pox. Anything claimed for it in that direction only relates to a possible second attack, but whatever occurs in America, poultrymen in New South Wales have no fear of second attacks upon the same bird.

The following is a statement of the case for the vaccine treatment, taken from the bulletin referred to :—

It is never recommended to vaccinate fowls before the appearance of the disease among them. The reason for this recommendation is that the length of time after vaccination that fowls are protected against the disease is variable, and after healthy flocks are vaccinated there is therefore no assurance that they will be protected longer than three or four months. If a flock is divided into a number of small pens and are under close observation, it may not be necessary to vaccinate the entire flock upon the appearance of the disease, but only the pens that are affected. In such cases the vaccine would be used on other pens as soon as the disease appears.

If the vaccine is properly administered it does not seem to have any harmful effect on the general condition of the birds. The egg yield, however, is usually somewhat decreased for a short time after vaccination, but as a rule this decrease will be no greater than would be expected if the fowls were handled for any other reason.

Chicken-pox as it affects poultry in this State is for the most part a disease of the late summer and autumn months, although it is sometimes present as early as January. Stock from three-fourths to full grown for the most part are the victims, it but rarely attacks birds over a year old, and then only through abrasions on the comb or fleshy parts Thus the disease is an affliction of the young birds. This State is singularly free from it during winter and spring. In Queensland and northern latitudes its incidence is somewhat different, trouble often being experienced some months earlier, so that it may affect chickens from the brooder stage onwards in parts of that State.

Poultry-farmers' attitude and outlook in relation to a vaccine will, I think, be that unless it is preventive in its incidence it can be of but little or no use to them. Once the disease has broken out the damage is done, and the main trouble is usually over inside of three weeks.

Rice at Yanco.

Rice was grown successfully on this experiment farm this year. The crop was kept under 6 inches of water from thirty days after sowing the seed until the grain had set. Very good growth was made, and the yield of 54 bushels per acre of " paddy " would be quite profitable. If a suitable market opens there is no reason why rice should not become one of the main crops on those low-lying parts of the area where there are means of draining off surplus water.—F. G. Chomley, Manager, Yanco Experiment Farm.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alterations of dates should be notified at once.

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